RUBBER
TEA
AND
OTHER TROPICAL PRODUCE

With the Compliments of

HARRISONS & CROSFIELD, LIMITED,

1/4, Great Tower Street, London, E.C. 3.

Published for Harrisons & Crosfield, Limited, by
Walter Judd, Limited, 97, Gresham Street, E.C. 2.

BARKER & Co., Ltd. (continued).

Robinson & Co., Limited.
Sandycroft Rubber Company, Limited.
See Kee Rubber Estates, Limited.
Semambu Rubber Estates, Limited.
Senawang Rubber Estates Company, Limited.
Shanghai Kelantan Rubber Estates, Limited.
Shanghai Pahang Rubber Estates, Limited.
Shanghai Seremban Rubber Estates, Limited.
Simpam Valley Hydraulic Mines, Limited.
Sua Manggis Rubber Company, Limited.
Sungei Bagan Rubber Company, Limited.
Sungala Rubber Estates, Limited.
Tai Tak (Johore) Rubber Estates, Limited.
Tanah Merah Estates (1916), Limited.
Tebak Tin Fields, Limited.
Tebrau Rubber Estates, Limited.
Ulobri Rubber Company, Limited.
Valentia and Skelligs Estates.

Local Agents and/or Secretaries in **Penang** for :—

Alma Estates, Limited.
Ayer Tawah Rubber Plantations Company, Limited.
Batu Balai Rubber Company, Limited.
Batu Lintang, Limited.
Bruas Rubber Company, Limited.
Bukit Kosa Estate.
Bukit Toh Alang Rubber Estates, Limited.
Chemor United Rubber Company, Limited.
Chenderiang Tin Dredging, Limited.
Cluny Rubber Estates, Limited.
Dindings Rubber Estates, Limited.
Errol Estate.
Gopeng Hills Syndicate, Limited.
Harap Rubber Plantations, Limited.
Kelubi Estate Syndicate.
Kinta Kellas Rubber Estates, Limited.
Klian Kellas, Limited.
Kamunting (in Kedah) Rubber Plantations Company, Limited.
Kamunting Tin Dredging, Limited.
Kota Bahroe Rubber Estates, Limited.
Krasom Prospecting Company, Limited.
Kuala Kangsar Plantations Company, Limited.
Ligertwood Estate.
Malaysia Rubber Company, Limited.

(Continued on page 13).

BARKER & Co., Ltd. (continued).

Old Kellas Estate.
Padang Gajah Rubber Company, Limited.
Penang Coconut Estates, Limited.
Rahman Hydraulic Tin, Limited.
Salamat Estate.
Shanghai Klebang Rubber Estates, Limited.
Shanghai Malay Rubber Estates, Limited.
Sungei-Duri Rubber Estate, Limited.
Tanjong Pau Rubber Estate.
Wagon Pachaung Wolfram Mines, Limited.

Insurance Agencies :—

Commercial Union Assurance Company, Limited.
Liverpool Victoria Insurance Corporation, Limited.
Ocean Accident and Guarantee Corporation, Limited.
Royal Exchange Assurance Corporation.
Royal Insurance Company, Limited.

Importing Agents for :—

Albion Motor Car Company, Limited, Glasgow (motor lorries).
Joseph Baker, Sons & Perkins, Limited ("Universal" washers)
Berger Manufacturing Company, New York (reinforced concrete work, &c).
Berkefeld Filter Company (British), London.
Braithewaite & Co., West Bromwich (tanks).
Clayton & Shuttleworth, Limited, Lincoln (oil engines, road rollers, caterpillar tractors, &c.).
Cleaver's Soaps, London.
Concrete Steel Company, New York.
Detroit Steel Products Company, Michigan.
Eno, J. C., Limited, London ("Eno's" Fruit Salts).
Harden Star, Lewis & Sinclair Co., Limited, London, (Fire extinguishing appliances).
Lee, Howl & Co., Tipton (pumps).
Lister, R. A. & Co., Limited, Dursley (lighting sets).
Marcovitch & Co., Limited (cigarettes).
Ogsten & Tennant, Limited, London (soap).
Polygon Inks, London.
Joseph Robinson & Co., Salford (rubber washing machinery).
John Smith & Son, Limited, London (varnishes).
Venesta, Limited, London (tea and rubber chests).
Wells Vegetable Fuel Power Company, Limited.

Consular Agents for France and Belgium in Penang.

Presented by
S. Murugappa
23.10.52

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HARRISONS & CROSFIELD, LTD., Head Office: 1/4, Great Tower Street, London, E.C. 3.

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HARRISONS & CROSFIELD, LIMITED.

"*Mobilitate viget, viresque acquirit eundo.*"

Formation of the business in Liverpool.

The House of Harrisons & Crosfield dates from 1844 when Daniel Harrison, Smith Harrison and Joseph Crosfield formed a partnership in the Tea business in Liverpool, Daniel Harrison having previously been in partnership with Octavius Waterhouse until 1842.

Without attaching undue importance to the date of a joint venture which had probably come about through personal relations uninfluenced by external events, it is worth while remarking on the legislative and economic landmarks of the early forties if only to emphasize the great changes in the conduct of our trade which were then taking place. The foundation of the house thus coincided with a period of wide legislative reforms, among the chief of which were the liberation of trade from tariffs and shipping restrictions; an era highly favourable to commercial enterprise and in particular to the development of business with the East.

Establishment in London.

The old monopoly of the East India Company came to an end. So long as it had remained in existence the Tea trade had been centred in Liverpool, but when the Company lost its charter the movement towards London went on apace and, before long, the greater facilities which the Capital offered as a distributing centre became apparent. From the commencement of the partnership Smith Harrison had regularly attended the fortnightly Tea Sales in Mincing Lane and as early as 1854 he persuaded his partners to move from their premises in 6, Temple Place, Liverpool, to London where offices were opened on the 3rd July at No. 3, Great Tower Street. Here in the homely fashion of those days the staff were boarded and lodged and, although the numbers were considerably increased from year to year and further accommodation at No. 11, Idol Lane, had to be taken in, this old time arrangement remained in force until 1882. By then the business had become a considerable one; for some years past the average annual sales had amounted to over 100,000 chests of tea and this progress went on steadily until the end of the nineteenth century, the firm acquiring its

own warehouses for the blending and storage of tea and developing a large business in the shipment of packets of tea under its own trade mark, the Nectar Brand.

Plantation Rubber. After 1900, however, tea ceased to be the firm's sole interest. The days of plantation Rubber had come and Harrisons & Crosfield were foremost in its development. They had established a branch in Colombo in 1895 under the name of Crosfield, Lampard & Co., of which the present Chairman, Mr. George Croll, was the first Manager. Another Branch (Lampard Clark & Co.) was opened at Calcutta in 1900; others followed under the name of Crosfield Lampard Clark & Co., at New York in 1903, at Montreal in 1905, and in November, 1907, at Kuala Lumpur, the Capital of the Federated Malay States. This was the last branch venture of the old partnership. The development of the business overseas, together with the growth of the Rubber Industry and the responsibilities which it entailed, had made it essential to ensure greater continuity than a partnership could afford, and accordingly in May, 1908, the business was registered as a Limited Company with a capital of £307,500.

Branches of the business.

Formation of Limited Company. The first Chairman of the Company was Mr. James B. Crosfield, who retired in 1911, after being connected with the business for more than 46 years, but who still takes a keen interest in the Company's welfare. The other Directors, all of whom except Mr. Miller had been partners in the business, were the following:—

- Mr. Charles Harrison (son of Daniel Harrison who founded the business) who retired in 1915.
- Mr. G. T. Crosfield, who retired in 1910 after 38 years as Partner and Director.
- Mr. C. Heath Clark, a Partner since 1894, and Chairman of the Company from 1911 to 1919.
- Mr. C. A. Lampard, who died in 1916, after a connection of 35 years with the business.
- Mr. George Croll, Chairman since 1919.
- Mr. H. E. Miller.

Board of Directors. Three of these, Mr. Clark, Mr. Croll and Mr. Miller are still Directors of the Company, and the other members of the present Board are Mr. G. S. Townend (1910), Mr. H. P. Church and Mr. H. J. Welch (1917), Mr. Eric Macfadyen, Mr. A. MacGregor MacColl and Mr. Haydn O. Peake (1919). Two other Directors have served on the Board—Mr. J. M. S. de Moraville (who opened up the firm's Mediterranean and general export business) from 1910 until his death in 1917, and Mr. Hugh T. Crosfield from 1910 until 1917 when he transferred to the Board of Twining Crosfield & Co., Ltd.

If further testimony be required to show that long service is a tradition with Harrisons & Crosfield, it should be recorded that since 1848 there have been only four cashiers :—

William Mackenzie	1848—1866
Richard Sedgwick	1866—1890
B. S. Grubb (now Procurator of the Company)	1890—1916
G. F. Seagrove	1916 to date.

Progress since 1908.

The progress made by the Company since its foundation in 1908 cannot be described in detail. As in the case of most growing concerns it has taken the form of a constant enlargement of the sphere of operations, with the devolution here and there of specialized branches of the business which can best be carried on by separate companies. Thus, for example, the blending, packeting and retail tea business is no longer carried on by Harrisons & Crosfield, Ltd., but has been handed over to Twining Crosfield & Co., Ltd.; the Australian and New Zealand business which was handled by a branch established in Melbourne in 1910, passed five years ago to an Australian Company (Harrisons Ramsay Proprietary Limited), and the New York business has been transferred to Irwin Harrisons & Crosfield Incorporated.

The progressive policy which the Company has always favoured has led to the development of an increasing Import and Export General Trade both on the part of the Company and the Associated Companies.

Interhouse Trading.

The interhouse Trading by which each concern is in the position of being able to supply direct has led to an expanding business, especially in the Far East and Australasia, in Machinery, Hardware, Soft Goods, Groceries, quite apart from the raw materials which each centre requires. This policy of interchange of products of the various countries in which Harrisons & Crosfield Ltd., are represented, places their customers throughout the world in a position to secure their requirements of raw materials or manufactured goods in the best market.

General Trading.

An important feature of the Company's activities in recent years has been the development of Estate work and general trading in the Dutch East Indies and elsewhere. Thus branches were formed in 1910 at Medan and Batavia (with sub-branches since established at Belawan, Siantar, Bandoeng, Sourabaya, etc.), and in 1912 at Quilon, South India. Further East a Branch was opened at Kobe in Japan in 1917 and a year later the Company's growing interests in Borneo were entrusted to a separate company, Harrisons & Crosfield (Borneo) Limited.

Capital.

The issued share capital of the Company has been increased several times since 1908, and now amounts to £1,844,986. *(See page 7).*

HARRISONS & CROSFIELD, LTD., SUMMARY OF BALANCE SHEETS 1914-1920.

ASSETS.	1914	1915	1916	1917	1918	1919	1920
	£	£	£	£	£	£	£
Property	306,523	316,029	365,300	392,180	423,946	534,413	934,771
Plant and Machinery	33,870	23,348	45,128	28,407	28,938	26,138	24,155
Furniture and Fittings	16,478	15,840	13,625	11,163	9,261	9,441	13,328
Stocks at cost or under	226,831	338,568	476,998	611,636	356,245	487,387	538,734
Loans	132,879	185,630	162,477	242,402	388,655	473,256	301,573
Debtors and Bills	241,672	304,809	411,880	598,822	378,720	403,294	803,456
Investments at cost or under	474,577	515,899	497,089	549,167	713,829	1,048,072	1,267,653
Cash	15,118	15,746	69,933	90,460	57,023	121,593	104,188
Pref. reserve fund (Investments and Deposit) ..	85,000	102,500	102,500	102,500	102,500	—	—
Acceptances per contra	—	255,673	253,890	240,431	239,406	167,806	449,170
Exps. of new Issue of Share Capital	—	5,595	—	—	—	—	—
TOTAL	1,532,948	2,084,637	2,398,820	2,867,168	2,698,523	3,272,400	4,437,028

LIABILITIES.	1914	1915	1916	1917	1918	1919	1920
Issued Capital	807,500	894,398	907,500	907,500	907,500	1,293,230	1,837,356
Reserve Funds	235,882	281,000	281,000	309,000	346,000	330,976	459,078
Mortgages	108,000	105,500	103,000	100,500	98,500	177,166	153,938
Sundry Depositors	29,463	155,911	161,538	157,414	119,141	170,778	385,861
Creditors and Bills	251,110	268,316	399,133	821,949	641,525	680,889	820,507
Bank Overdrafts	345	15,899	162,969	178,534	189,921	335,370	234,047
Acceptances per contra	—	255,673	253,890	240,431	239,406	167,806	449,170
P. & L. A/c. Balance	100,648	107,940	129,790	151,840	156,530	115,701	97,071
TOTAL	1,532,948	2,084,637	2,398,820	2,867,168	2,698,525	3,272,400	4,437,028

Besides providing the extra working capital which the enlargement of the business has necessitated, this money has been utilised in providing the handsome offices which now stand at 1-4 Great Tower Street, and large premises in Colombo, Medan, Batavia, Kuala Lumpur and elsewhere. These include not only offices but, in the case of Colombo, an extensive range of mills now nearing completion, and at Quilon engineering and tile works, and saw mills.

Estate Work.

Finally a word as to the Company's Estate work. Since the early days of the Rubber plantation industry, Harrisons & Crosfield have been interested in the development of Rubber Estates and in acting as Secretaries and Agents of Rubber, Tea and other Produce Companies. This branch of their work is well known to the public by reason of the important position to which many of the Companies have attained, but it may be of interest to give a complete list as follows :—

COMPANIES FOR WHICH HARRISONS & CROSFIELD, LIMITED, ACT AS SECRETARIES AND AGENTS :—

F. M. S. and Straits Settlements.

The Anglo-Malay Rubber Co., Ltd.
The Bikam Rubber Estate, Limited.
Cluny Rubber Estates, Limited.
Coconut Plantations of Perak, Limited.
The Golden Hope Rubber Estate, Limited.
Lanadron Rubber Estates, Limited.
Ledbury Rubber Estates, Limited.
The London Asiatic Rubber & Produce Co., Ltd.
Malayasia Rubber Co., Ltd.
The North Labis (Johore) Rubber & Produce Co., Ltd.
The Pataling Rubber Estates, Ltd.
The Pernambang Rubber Estates, Ltd.
The Rubber Estates of Johore Ltd.
Seaport (Selangor) Rubber Estate, Ltd.
The Selaba Rubber Estates, Ltd.
The Straits Plantations, Ltd.
The Strathisla (Perak) Rubber Estates, Ltd.
Sungei Dangar (Malay) Rubber Co., Ltd.
The Sungkai-Chumor Estates, Ltd.
Tai Tak (Johore) Rubber Estates, Ltd.
Tangkah Rubber Estate Limited.
Tebolang Rubber Estates, Ltd.
Victoria (Malaya) Rubber Estates, Ltd.

Sumatra.

Asahan Rubber Estates, Ltd.
The Bah Lias Tobacco & Rubber Estates, Ltd.
Bila (Sumatra) Rubber Lands Ltd.
The Central Sumatra Rubber & Produce Estates, Ltd.
Deli Estates Engineering & General Union Ltd.
The Mendaris (Sumatra) Rubber & Produce Estates, Ltd.
The Sialang Rubber Estates, Ltd.
The Soengei Rampah Rubber & Coconut Plantations Company, Limited.
The Tandjong Rubber Co., Ltd.
The Toerangie (Sumatra) Rubber & Produce Estates, Limited.
The United Serdang (Sumatra) Rubber Plantations, Ltd.
The Wampoe Tobacco & Rubber Estates, Ltd.

Java.

The Ankola Tea & Rubber Company, Limited.
The Bajoe Kidoel Rubber & Produce Co., Ltd.
The Djasinga Rubber & Produce Co., Ltd.
Kasintoe Rubber Estates, Ltd.
The Langen (Java) Rubber Estates, Ltd.

Ceylon.

The Bambrakelly (Ceylon) Tea & Rubber Co., Ltd.
The Hingurugama Tea & Rubber Estates, Ltd.
The Lunuva (Ceylon) Tea & Rubber Estates, Ltd.
The Negombo (Ceylon) Coconut Estates, Ltd.
The Sapumalkande Rubber Co., Ltd.

India.

The East Indian Tea & Produce Co., Ltd.
The Malayalam Rubber & Produce Co., Ltd.
The Meppadi Wynaad Tea Co., Ltd.
The Wallardie Tea Estates, Ltd.

Borneo.

The British Borneo Timber Co. Ltd.
Cowie Harbour Coal Co., Ltd.

THE RUBBER PLANTATIONS INVESTMENT TRUST, LTD.

In addition to the Companies mentioned above, Harrisons & Crosfield, Ltd., act as Secretaries of The Rubber Trust which was incorporated in March, 1909, with an Issued Capital of £250,000. Mr. C. A. Lampard was the first Chairman. Further issues have been made from time to time to keep pace with the development of the Industry, until to-day the Issued Capital is approximately £2,000,000. Owing to the widespread nature of the Trust's interests in Tea and Rubber, the Company has always been regarded as the most responsive barometer to the conditions of the Tea and Rubber Markets, and variations in the prospects of the Industries are always promptly reflected in the price of its shares.

In addition to large investments in such Companies, the Trust owns areas in the East amounting to nearly 100,000 acres, of which over 15,000 acres are in Rubber and Tea cultivation; the greater part of this acreage is on the East Coast of Sumatra.

ASSOCIATED COMPANIES.

BARKER & COMPANY, LIMITED.

Singapore   Penang   Malacca   Kuantan

HARRISONS RAMSAY PROPRIETARY LIMITED.

Adelaide   Auckland   Brisbane
Christchurch   Dunedin   Melbourne
Perth   Sydney   Wellington

HARRISONS & EASTERN EXPORT LIMITED.

Colombo   Calcutta

HARRISONS & CROSFIELD (BORNEO) LTD.

Sandakan   Jesselton

HARRISONS KING & IRWIN LIMITED.

Foochow   Hankow
Shanghai   Tientsin

IRWIN-HARRISONS & CROSFIELD INCORPORATED.

Boston   Chicago   New York
Philadelphia   San Francisco

TWINING CROSFIELD & CO., LTD.

London.

BRANCHES of

HARRISONS & CROSFIELD, Limited.

BATAVIA	CALCUTTA	COLOMBO
KOBE	KUALA LUMPUR	MEDAN
MONTREAL	QUILON	TANGIER

with offices and sub-branches at:—

CALICUT, COCHIN, TRIVANDRUM, ALLEPEY &c., SOUTH INDIA;
PORT SWETTENHAM and KLANG, MALAYA;
BANDOENG and SOURABAYA, JAVA;
BELAWAN, LABOEAN BILIK, SIANTAR, TANDJONG BALEI and TEBING TINGGI, SUMATRA.



Colombo Office.



Medan Office.



Kuala Lumpur Office.

PLANTATION RUBBER.

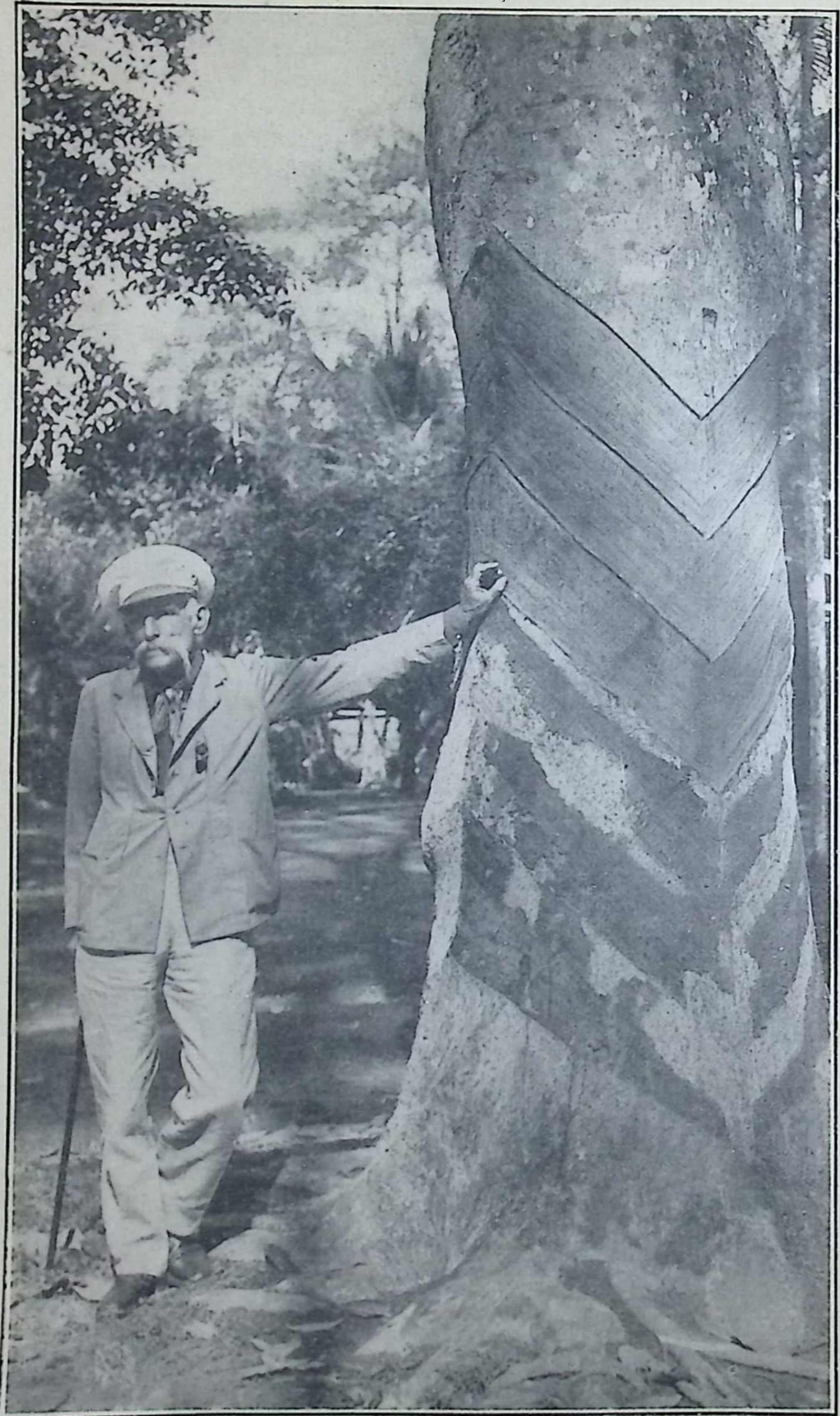
(*Hevea Brasiliensis.*)

RUBBER is obtained from a milky substance called latex which occurs in the bark of certain species of tropical trees. It appears that Columbus noticed it on his second voyage to America, having observed the natives playing games with balls of an elastic substance, but it does not seem to have attracted much attention until its properties were investigated by the English Chemist, Priestley, who discovered that this substance was very effective in removing pencil marks from paper, and for this reason he called it India Rubber. It was, however, regarded as a scientific curiosity, and not until 1791 did it become used to any extent as a commercial product. In that year Peal started to waterproof cloth by brushing hot rubber on to it, and 20 years later Clark, making use of the fact that rubber is soluble in turpentine, used this solution for the manufacture of air beds.

Three great discoveries, made during the first half of the last Century, were the cause of the world wide use of Rubber to-day. The first was made by Macintosh of Glasgow, when he found that rubber was soluble in Naphtha and that by spreading this solution over a piece of cloth and allowing the Naphtha to evaporate the cloth was made waterproof.

The next discovery was made by Hancock, when he found the method of uniting pieces of pure rubber into a solid mass by a mechanical process called mastication.

Though these two discoveries established the use of rubber as a commercial commodity, and thereby slowly, but steadily, increased the quantity consumed, the behaviour of pure rubber when subjected to ordinary seasonal changes of temperature was a serious hindrance to its extensive use in manufacture. Cold weather made it hard and somewhat brittle; hot weather, soft and sticky, and had it not been for the third great discovery made independently by Goodyear in America, and Hancock in this country, its commercial use would have been seriously restricted. These two men discovered that if rubber is heated with sulphur under carefully regulated conditions (vulcanisation), a new product is formed which is little affected by ordinary seasonal variations of temperature, and it is not too much to say that this discovery made possible the whole modern development of the Rubber Industry, and made rubber a commodity essential to the general well-being of mankind.



SIR HENRY A. WICKHAM.

By kind permission of the "Times of Ceylon."

The trees from which rubber is obtained were originally found in Central and South America, especially in Brazil, though the forests of Tropical Africa also contained rubber producing trees. The only source of raw Rubber up to the end of last century was from these countries, the finer qualities coming from Brazil: and though there is still a considerable amount of Brazilian and other wild rubber put on the market, their total quantity is small compared with that which nowadays is produced in the great rubber plantations of the East.

The rise of the rubber plantation Industry may be said to date from 1876, when about 2,000 seedlings of the rubber tree, Hevea Brasiliensis, were planted in Ceylon. The idea of planting rubber on a large scale in the East appears to have been first suggested by Hancock in 1834, but it was not adopted then. In 1876, Mr. (now Sir) Henry A. Wickham, a man of great enterprise, was commissioned by the Government of India, to collect seeds of the Hevea Brasiliensis, in the rubber areas of the Valley of the Amazon. These seeds were taken to Kew, germinated and despatched to Ceylon, and were planted in the Botanic Gardens at Henaratgoda, whence plants were distributed to Singapore and elsewhere. To Singapore or Henaratgoda, directly or indirectly, the whole of the Rubber Plantations in Malaya and Ceylon, in the Netherlands Indies and India, owe their existence.

To-day, the actual planted Area in the East is about 3¼ millions acres of which about 2¼ million acres are in bearing, and producing under normal conditions about 340,000 tons of rubber annually. This great plantation Industry has been brought into existence mainly by British capital and enterprise, and Great Britain holds a leading position in the rubber manufacturing industry, being second only to the United States of America.

The labour employed on the plantations is drawn principally from India, Java and China. These labourers live a happy and contented life on the Estates, are paid good rates of pay and are comfortably housed in soundly constructed permanent buildings with every attention paid to sanitary conditions. Under Government regulations estates must provide proper medical supervision by a qualified medical officer, and each estate or group of estates has its own hospital and dispensary. There is a native bazaar where the coolies can buy food &c., and on many of the estates rice is supplied by the Companies at less than cost price.

To obtain the rubber from the trees, incisions are made in the bark (tapping) and the latex or milky substance which flows from the incisions is collected in cups and then taken to the Factory. In the Eastern plantations acetic acid is used to speed up the coagulation of the latex, which is then washed and dried and usually made up in either of the two forms known as Crepe and Smoked Sheet. In Brazil, the coagulation is done more crudely by exposing the latex in thin layers to dense hot smoke, and the product is put on the market in the form of large balls. First quality is known as Fine Hard Para, having received its name from the chief port of shipment.



A RUBBER ESTATE.

With regard to the uses of Rubber, by far the most important is the manufacture of Automobile Tyres and Tubes, and it is estimated that between 60 and 70 per cent. of the world's output of rubber is used for this purpose. Next in importance come rubber goods consisting of rubber belting, rubber hose, rubber mats, etc. ; and this is followed by boot and shoe supplies. These two classes together absorb about 25 per cent. of the world's output. Finally, rubber floors and pavements, druggists sundries, waterproof cloth, &c., account for the remainder.

ACREAGE UNDER RUBBER.

	Area Planted 1st Jan., 1920.	Producing Acres.
Malaya	1,750,000	1,250,000
Ceylon	398,000	267,000
S. India	65,000	43,000
Burma	45,000	17,500
Netherlands Indies ...	885,000	570,000
British North Borneo ...	50,000	30,000
Other Countries	130,000	60,000
Total ...	3,323,000	2,237,500

EXHIBITS FROM INDIA, CEYLON, F.M.S., STRAITS SETTLEMENTS, SUMATRA & JAVA.

HEVEA BRASILIENSIS.	Small branch of Hevea Rubber Tree, showing the flower. (Bot. Spec.)
HEVEA BRASILIENSIS.	Small branch of Hevea Rubber Tree, showing the fruit. (Bot. Spec.)
HEVEA BLOSSOM AND FRUIT.	Preserved in formaline. (*a*) Flowers—male and female. (*b*) Fruit—one to one-and-half months old. (*c*) Fruit—approximately four months old. (*d*) Fruit—Approximately five months old—nearly ripe.
HEVEA RUBBER SEED.	(*Hevea Brasiliensis.*) The trees yield quantities of these containing a large percentage of oil which should form a valuable by-product.
HEVEA RUBBER SEED.	Showing the method of packing in charcoal, for transport and propagation elsewhere.
KERNEL OF HEVEA RUBBER SEED.	From this the oil is expressed.
HEVEA RUBBER SEED OIL.	Possessing almost the same properties as linseed oil.
HEVEA RUBBER SEED OIL CAKE.	Being the residue after the extraction of the oil.
CASE OF RUBBER SEED.	The collection of Rubber Seed has called for careful study as it is important that seed from the best producing trees only should be propagated in nurseries. The seed scatters widely when the pod bursts so it might be wrong to assume that a particular seed is derived from the tree under which it is found. A peculiar characteristic, however, which provides an aid to proper selection, is that all the seeds from one tree are similar to one another in shape and marking and dissimilar in these respects from seeds from any other tree. The seeds in the case exhibited were collected to demonstrate the above. Each compartment contains specimens of the seeds of one tree only.

HEVEA SEEDS AND SEEDLINGS.	Preserved in Paraffin Wax. (*a*) Hevea seeds in various stages of germination. (*b*) Hevea seedlings 9 days to 3 weeks old. (*c*) Hevea seedlings 10 weeks old.
HEVEA STUMPS.	Preserved by treating with a 50 per cent. Solution of Carbolineum Heveaum. (*a*) Stumps 14 months old showing root system. (*b*) Stumps cut ready for planting out.
SECTION OF TRUNKS OF HEVEA RUBBER TREES.	Showing the herring bone system of tapping. ,, the half ,, ,, ,, ,, the quarter ,, ,, ,, one third ,, ,, ,, half spiral ,, ,, ,, basal V ,, ,,
LATEX.	Obtained by tapping bark of Hevea Rubber Trees.
COAGULATED LATEX.	Produced by the addition of dilute acetic acid which causes the rubber to separate from the watery portions of the sap.
ACETIC ACID.	This is the most generally used coagulent for Hevea Latex.
SODIUM BISULPHATE.	Used to prevent darkening of the rubber after coagulation.
BISCUIT RUBBER.	This is the earliest form in which plantation rubber was made—only manufactured now on small native estates.
BLOCK RUBBER.	This is made from pale crepe which is vacuum dried and then consolidated in a hydraulic press. (Lanadron Estate.)
SMOKED SHEET.	Strips of coagulum about 1½ins. thick are taken from tanks or pans and passed through smooth rollers, finally through marking rollers reducing thickness to ⅛in. The sheet is then placed in a Smoke House for a period of 10 to 15 days, by which time the rubber should be thoroughly cured and free from moisture. Dry timber as fuel gives best results.

No. 1 Crepe.

The latex is strained and, after skimming, a solution of bisulphate is added for each litre of pure latex—1 gram on dry days and $1\frac{1}{2}$ grams on wet days. This solution is well stirred in. After skimming again a solution is added of 1 cub. c.m. acetic acid per litre of pure latex and the bulk thoroughly stirred, skimmed again and the jar closed. After the lapse of about an hour the latex has become coagulated. The mass is then torn to pieces and kept under water in the factory until it is time for milling. If it is machined at once the rubber requires to pass through the mills 9 times. Thereafter the crepe sheets are hung up in the Drying Shed in a dry warm atmosphere where they become dry in 3 or 4 days and after sorting are packed.

Compo Crepe.

This rubber consists of skimmings, lump from the pails and sieves and selected clean scraps. These grades are mixed in about equal quantities in the Universal Washer. A kind of "sausage" is the resultant and this is creped in the machinery. As these "sausages" are very hard, milling occupies a long time and after washing this rubber passes through the machines on an average 12 times. Thereafter the crepe is hung up in the Drying Shed when it becomes dry in 7 or 8 days, is packed and despatched. Should there be differences in colour care is taken that so far as possible Crepes of one colour are packed in a case.

Earth Scrap.

This rubber consists of shavings, earth rubber and black scraps. In order to avoid loss the shavings are washed out in the first mills. To pass them through the Universal takes too long before they cohere. These lumps are mixed together in about equal quantities with the black scraps and earth rubber and cleaned as much as possible. These "sausages" are again passed through the Mills and creped. On an average they are machined 12 times.

Smoked Sheet.

The Latex is received as in the case of No. 1. In order to prevent premature coagulation 125 cub. c.m. formaline per 240 litres pure Latex is added. In the tanks the Latex is reduced to 15 per cent. Latex content. By sampling it is ascertained how many litres of Latex are required in order to obtain

a sheet of 3 lbs. A solution of Acetic Acid is then added of 9 cub. c.m. in the case of immediate milling and 8 cub. c.m. if the sheets are to stand over one night. The coagulum passes through Smooth Rollers 8 times and thereafter through the Marker. After that the sheets are washed with soap and hung up to drip and afterwards placed in the Smoke House. The temperature is immediately raised to between 110 and 120 degrees. Each day the position of these sheets is altered somewhat in order to avoid as much as possible the appearance of the dark stripe from the racks. Generally the sheets are dried and smoked sufficiently after about 8 to 10 days. Sometimes there are sheets which remain moist at the edges and these are hung up in the crepe Drying House until they are dried. The sheets are cleaned of dust and if necessary washed and dried again. After sorting the sheets are packed and despatched. So far as possible sheets of one colour are packed in a case.

CURLY TREE SCRAP. Untreated Tree Scrap—chiefly sent forward from native owned Estates in Ceylon.

BROWN BAST. Specimens of Burrs that were taken out of diseased Rubber Trees. One is about 2 feet long, 6 inches wide, and was before treatment 3 inches thick, raised from the surface of the tree. The trees were giving no latex and quite untappable when first treated in 1916, now they are in full tapping, with a perfect renewal of bark and no disease. Age of rubber 10/11 years.

DISEASE.

1. Section of trunk showing severe knobby canker. The tree was treated first against Brown Bast, but is one of the few types on which, notwithstanding good treatment, wood growths appeared.
2. Section of trunk showing stripe canker treated timeously with Solignum (as the Solignum is somewhat invisible owing to the sublimate it has been scraped a little.) As can be seen hardly any trace of stripe canker remains.
3. Section of a Trunk showing stripe canker treated with Solignum mixed with petroleum. It is remarkable that on almost every tree treated with this mixture (as also in the case of a neigh-

bouring Estate) a later effusion occurs on the stripe canker mark. A bubble results and if cut a piece of latex may be withdrawn. It is also remarkable that these wounds have healed well, but for a long time show a scar.

4. Section of trunk showing tapping surface treated too late for stripe canker. One can see the type of ugly marks obtained in this manner. These wounds heal quickly but for a long time retain an ugly knot. This is in contrast to the wound caused as described in No. 3.

TRANSPORT. Wardian case, kindly lent by the Trustees of Kew Gardens, showing the method of packing plants for Transport to the Tropics.

NOTE :—For particulars of tapping tools and estate supplies see page 71.

PHOTOGRAPHS.

JUNGLE. Showing the dense undergrowth.

FELLING the jungle.

BURNING the jungle after it has been felled and left to dry.

CLEARING ready for planting with Rubber.

NURSERY of young rubber seedlings.

HOLEING AND PLANTING. The distance apart is usually 20 feet by 20 feet.

TERRACING on steep land to prevent loss of surface soil.

DRAINING the clearings.

WEEDING young rubber fields.

ROAD MAKING.

THREE YEAR OLD RUBBER TREES.

SEVEN YEAR OLD RUBBER TREES.

SPECIMENS OF OLD RUBBER TREES.

TAPPING RUBBER TREES.

COLLECTING the latex in the field.

TRANSPORT of latex to Factory.
(*a*) Carried by the coolies.
(*b*) Bullock Waggon.
(*c*) Motor Lorry.

RECEIVING latex at Factory.

RUBBER FACTORY. Exterior.

RUBBER FACTORY. Interior.

MEASURING and testing the latex with Metrolac.

BULKING the latex in large earthenware vats.

COAGULATING RUBBER—in pans.

ROLLING the rubber into sheets.

MARKING the rubber with ribbed or diamond pattern rollers.

SMOKE HOUSE. Exterior.

SMOKE HOUSE. Interior.

DRYING HOUSE. Crepe being dried naturally.

VACUUM DRIER. Crepe being dried artificially.

GRADING the rubber for packing.

PACKING AND WEIGHING—the rubber.

TRANSPORT to the coast (*a*) By Bullock Waggon.
(*b*) By Motor Lorry.
(*c*) By Wallam.

SHIPPING. Rubber Cases being loaded on steamer.

MANAGERS BUNGALOW.

ASSISTANTS BUNGALOW.

CENTRAL HOSPITAL.

OPERATING ROOM AND LABORATORY.

NATIVE WARD.

DRESSING ROOM.

DINING ROOM.

ESTATE HOSPITAL.

DISPENSARY.

APOTHECARIES' HOUSE.

RUBBER MAKER'S HOUSE.

COOLIE LINES.

ESTATE CADDY OR STORE.

RICE STORE.

WATER INSTALLATION.



TAPPING RUBBER TREES.

STATISTICS.

PRODUCTION OF PLANTATION RUBBER, 1910-1920 (in tons).

Year.	British Malaya.	Ceylon.	Netherlands, East Indies.	Other Countries.	Total.
1910	6,500	1,500 (*a*)	600	400	9,000
1911	10,800	2,900 (*a*)	1,500	800	16,000
1912	20,300	6,700 (*a*)	2,700	1,400	31,100
1913	33,600	11,400 (*a*)	5,400	2,300	52,700
1914	47,000	15,800 (*a*)	11,600	2,900	77,300
1915	70,200	20,800 (*a*)	20,200	4,500	115,700
1916	99,100	24,400 (*a*)	34,400	7,000	164,900
1917	129,900	31,800 (*a*)	48,000	9,500	219,200
1918	133,400	28,000 (*b*)	58,000	10,400	229,800
1919	176,800	38,000 (*b*)	76,000	12,200	302,000
1920	193,000	42,000 (*b*)	85,000	15,000	335,000

(*a*) Export figure.
(*b*) Estimated.

THE IMPORTS OF CRUDE RUBBER INTO THE PRINCIPAL CONSUMING COUNTRIES.

	United States Tons	Great Britain Tons	France Tons	Italy Tons	Japan Tons	Germany Tons	Austria Tons
1910	42,200	20,500	3,800	2,200	700	13,700	2,000
1911	38,500	16,700	5,400	2,700	900	15,100	2,300
1912	53,000	18,700	4,600	3,900	900	15,400	2,600
1913	52,200	25,300	6,500	2,000	1,200	16,300	2,700
1914	61,200	18,500	5,000	4,000	1,000	11,000(*a*)	1,400
1915	96,800	15,100	10,800	6,600	1,700	6,000(*a*)	—
1916	116,500	26,700	14,700	8,600	3,000	3,000(*a*)	—
1917	177,100	26,000	17,000	6,900	3,700	2,000(*a*)	—
1918	142,800	30,100	18,000	7,700	7,300	—	—
1919	237,000	42,500	20,500	10,000	10,800	4,000	—
1920	248,800	57,000	16,300	6,100	6,100	12,000	—

(*a*) Estimate given by War Industries Board of America.

No reliable figures are available for Russia, but it is estimated that her Imports for 1913 were somewhere between 10,000 and 15,000 tons.

TEA.

(*Camellia Thea.*)

THE Tea shrub is indigenous to Assam and it is supposed to have been imported into China about the year 500 A.D. The Chinese were quick to appreciate the virtues of Tea as a beverage, and at so distant a period as 1000 years ago their writer and historian Lo Yu wrote of Tea "It tempers the spirits and harmonises the mind, dispels lassitude and relieves fatigue, awakens thought and prevents drowsiness, lightens or refreshes the body, and clears the perceptive faculties." The truth of this early description is fully substantiated by modern experience throughout the civilised world with one important additional attribute of the beverage, viz., that the exhilarating effects are not followed by depression as in the case of alcoholic stimulants.

Tea was first introduced into England about the year 1650, and the first Tea house was opened in London in 1657.

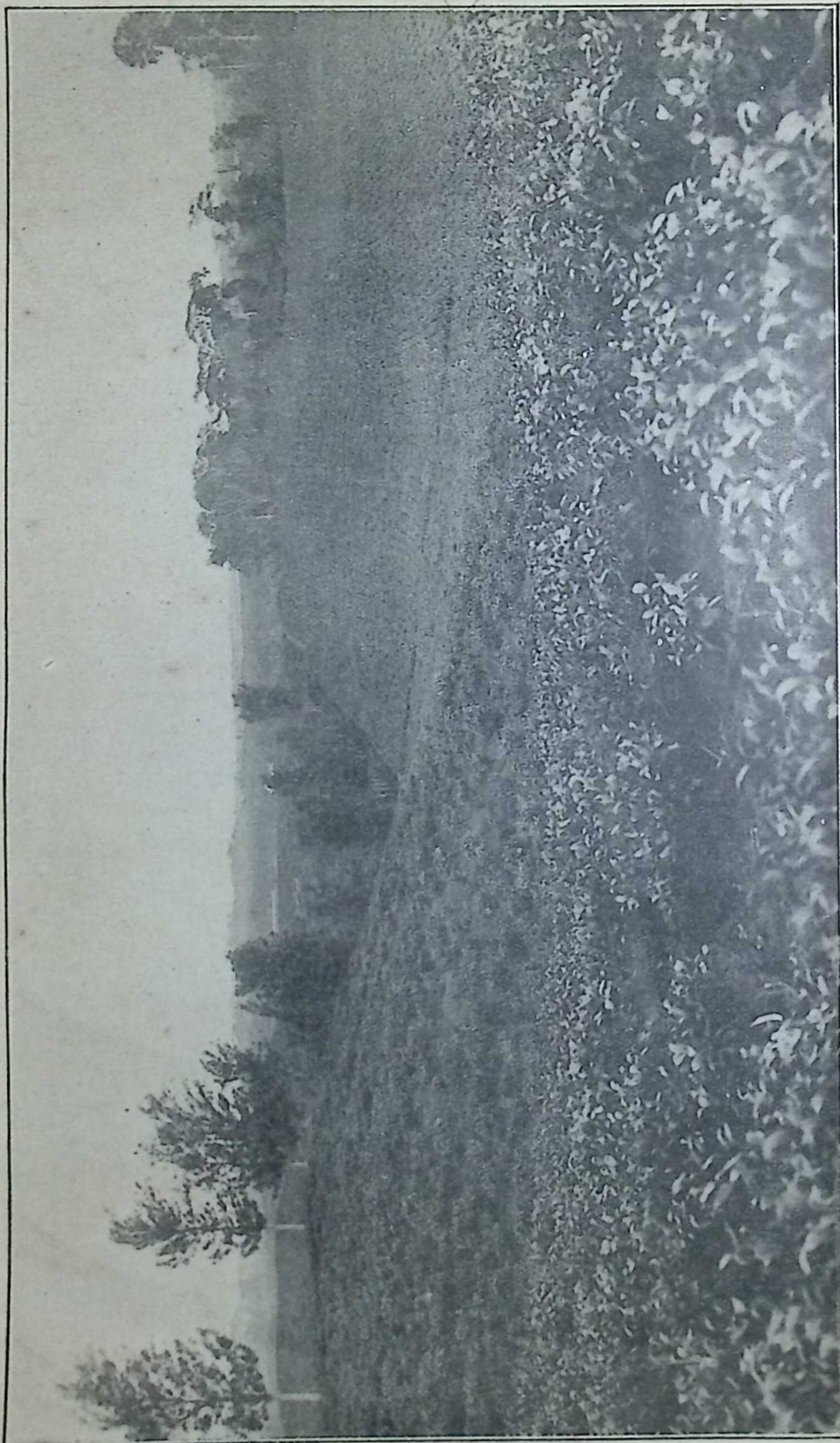
In the year 1834 the Governor General of India recommended the cultivation of Tea in that Country. Unfortunately the Planters, being unaware that the forests they were clearing for planting purposes contained Tea trees, used seed imported from China which resulted in failure. Subsequently, however, successful experiments were carried out with indigenous and hybrid Teas of several varieties, and since 1853 the Tea industry has been successfully carried on.

Tea cultivation in Ceylon may be said to have first commenced on a commercial basis in 1867, although it was introduced to the Botanic Gardens there as far back as 1824.

In 1869 the Tea industry in Ceylon received a great impetus. This was due to the fact, that owing to a disease (*Hemeleia vastatrix*) known as the "Coffee leaf disease" attacking the Coffee trees and practically devastating the Coffee planted areas, the Planters were forced to divert their attention from Coffee to other products particularly Tea, which they found grew very successfully on the old Coffee lands.

The first exports of Tea from India, on a commercial scale, were made in 1840, and from Ceylon in 1880.

By the year 1890 India was producing 112 million lbs. and Ceylon 47 million lbs.



A TEA ESTATE.

The Tea industry in Java was developed concurrently with Ceylon, but on a somewhat smaller scale.

As recently as the year 1910 the Rubber Plantations Investment Trust opened up and planted the first Tea estates in Sumatra, and the annual production of that country has already reached 10 million lbs.

In 1849 the consumption of Tea in the United Kingdom reached 50 million lbs., all of which was China Tea, whereas by 1919 the consumption had mutliplied almost eightfold, and amounted to 388 million lbs., of which less than 5 million lbs. consisted of China Tea.

It is estimated that in 1919 the average amount of Tea consumed per head of the population of the United Kingdom was 8.42 lbs. as compared with .82 lbs. Coffee and 3.19 lbs. Cocoa.

PLANTING. Tea seed is obtained from Bushes specially cultivated as "Seed bearers." The seeds are usually sown in germinating beds, or Nurseries and about 9 to 12 months after germination, transplanted into the clearings. The plants are put out in rows usually 4 feet apart and 3½ feet apart in the rows, and this works out at about 3,250 plants per acre. At about 4 years of age the plant reaches maturity, but a year before being plucked it has to be pruned down to about 9 or 12 inches from the ground. The bushes are plucked regularly every eight or nine days for two to two and a half years, when they are again pruned.

PLUCKING. Plucking is mostly done by female coolies. If it is desired to produce only the most delicate quality then only the bud and the two youngest leaves are plucked. When a larger yield is required then three or even four leaves may be plucked from the top of the shoot downwards. After plucking, the leaves are conveyed in baskets to the Tea Factory and carefully weighed and sorted. This latter operation is necessary in order to eliminate the carelessly plucked coarse leaves and pieces of stalk.

WITHERING. The green leaf is then withered. The leaves are spread on shelves of jute hessian and left to wither for about 24 hours. This is a process which is most important as it has for its object the evaporation of the moisture in the leaf. During this process the green leaf loses approximately 50 per cent. of its weight. Successful withering depends on good light and a dry atmosphere, experience teaching those in charge just when the leaves must be removed.

ROLLING. The next process is that of rolling, during which the sap cells of the leaf are broken and incidentally the leaves are given the twisted appearance noticeable in the finished product. The leaves are then passed through the roll-breaker which breaks up the balls or lumps into which the leaves have formed.



PLUCKING TEA.

FERMENTING. The leaves are afterwards spread on wooden frames, covered with wet cloths, and allowed to ferment. The extent to which this is allowed to go determines to a large extent the quality of the Tea.

FIRING. The process of firing is next carried out. The leaf is spread thinly on perforated trays which are passed through a machine where a current of hot air from 180 to 220 deg. Fahr. is forced through them. The leaves when taken out are dry and brittle and black in colour.

SIFTING. The Tea after it has been cooled is passed through a sifting machine which sorts the tea into various grades.

PACKING. Packing is usually done by machinery. The lead lined chest is placed on a platform which oscillates at about two thousand revolutions a minute. The tea is slowly poured into the chests and settles down so that the utmost capacity of the Chest is made use of. A sheet of lead is then soldered on top and the lid nailed on and bound with hoop iron. The chest is then ready to be transported to the railway station or Port of Shipment.

AREA PLANTED WITH TEA AT 31st DECEMBER, 1919.

	Acres
India	692,000
Ceylon	403,500
Java and Madœra	210,851
Sumatra	22,109
	1,328,460

EXHIBITS FROM INDIA, CEYLON, SUMATRA & JAVA.

BRANCH OF TEA BUSH.	Showing the various leaves named—(Bot. Spec.)
BRANCH OF TEA BUSH.	Showing the fruit and section of seed—(Bot. Spec.)
TEA SEED.	Bushes are specially grown for the production of seed.
TEA SEED.	Showing the method of packing in charcoal for transport and propagation elsewhere.
TEA SEEDLINGS.	Showing germination of seed 14 days after sowing.
TEA SEEDLINGS.	Ready for planting out in the field.
BASKET PLANTS.	Seeds are planted in the nurseries in small wicker baskets which prevent the roots from being disturbed when the seedlings are being transplanted.
TEA BUSH.	(*a.*) Mature Plant. (*b.*) Specimen of stumps pruned at 9 inches. (*c.*) Specimen of stump pruned at 6 inches. (*d.*) Specimen of tea bush cut across at 18 inches. (*e.*) Specimen of tea bush pruned at 9 inches.
TEA.	Samples of all grades of Black Tea. Samples of all grades of Green Tea.

PHOTOGRAPHS.

JUNGLE showing the dense undergrowth.

FELLING the jungle.

BURNING the jungle after it has been felled and left to dry.

DO. The jungle on fire.

CLEARING ready for planting with Tea.

NURSERY of young tea plants.

HOLING AND PLANTING. The distance apart is usually 4 feet by 5 feet.

TERRACING on steep land to prevent loss of surface soil.

DRAINING the tea clearings.

WEEDING young tea fields.

ROAD MAKING.

TEA FIELDS. 2 year old bushes.

TEA FIELDS. Mature Tea.

PLUCKING tea.

TRANSPORT of leaf to factory.

FACTORY. Exterior.

DO. Interior.

WEIGHING the green leaf at factory.

SORTING. Picking out any inferior leaf and stalk.

WITHERING. The green leaf is spread thinly on trays or tats of jute hessian.

WITHERING SHED. Where the green leaf is withered with hot air during the monsoon weather.

ROLLING. In these machines the sap cells of the withered leaf are broken by pressure and movement, and incidentally the leaf receives the twist which is noticeable on finished tea.

ROLL BREAKER, which breaks apart the leaves which get clogged together during the rolling.

FERMENTING ROOM. Here the rolled leaf becomes fermented or oxidised, distinguishing it from green or unfermented tea.

FIRING. The fermented leaf is dried in the machine at a temperature of from 180 to 220 degrees Fah.

GRADING. By means of the cutting and sifting machines the grades of Broken Orange Pekoe, Pekoe, Fannings, &c., are separated.

PACKING AND WEIGHING. The tea is compressed into the chests by a rapid vibration of the platforms of the packing machine.

TRANSPORT TO COAST. By Wallam (Indian native boat).
,, Bullock waggon.
,, motor lorry.

SHIPPING. Tea being loaded on steamer.

STATISTICS.

As to the Non-Alcoholic Drinks of the people of the United Kingdom.

Years.	Population United Kingdom.	Average Consumption per Head of Population.			
		Tea lbs.	Coffee lbs.	Cocoa lbs.	Total lbs.
1840	26,487,026	1.22	1.08	.08	2.38
1841	26,751,199	1.37	1.06	.07	2.50
1842	27,000,447	1.38	1.06	.08	2.52
1843	27,255,699	1.48	1.10	.09	2 67
1844	27,525,119	1.50	1.14	.09	2.73
1845	27,776,364	1.59	1.23	.09	2.91
1846	28,002,094	1.67	1.31	.11	3.09
1847	27,972,537	1.66	1.34	.11	3.11
1848	27,820,088	1.75	1.33	.10	3.18
1849	27,669,579	1.81	1.24	.12	3.17
1850	27.523,694	1,86	1.13	.11	3.10
1851	27,393,337	1.97	1.19	.11	3.27
1852	27,448,257	1.99	1.27	.12	3.38
1853	27,542,588	2.14	1.35	.15	3 64
1854	27,658,704	2.24	1.35	.16	3.75
1855	27,812,730	2.28	1.29	.16	3.73
1856	28,011,031	2 26	1.25	.13	3.64
1857	28,188,280	2.45	1.22	.09	3.76
1858	28,389,770	2.58	1.24	.10	3.92
1859	28,590,224	2.67	1.20	.11	3.98
1860	28,778,411	2.67	1.23	.11	4.01
1861	28,974,362	2.69	1.21	.12	4.02
1862	29,255,015	2.70	1.18	.12	4.00
1863	29,433,918	2.90	1.11	.13	4.14
1864	29,628,578	3.00	1.06	.13	4.19
1865	29,861,908	3.29	1.02	.13	4.44
1866	30,076,812	3.42	1.02	.14	4.58
1867	30,334,999	3.68	1.04	.14	4.86
1868	30,617,718	3.52	1.00	.17	4.69
1869	30,913,513	3.63	.94	.19	4.76
1870	31,205,444	3.81	.98	.20	4.99
1871	31,513,442	3.92	.97	.23	5.12
1872	31,814,183	4.01	.98	.24	5.23
1873	32,177,550	4.10	.99	.26	5.35
1874	32,501,517	4.22	.96	.27	5.45
1875	32,838,758	4.43	.98	.30	5.71
1876	33,199,994	4.49	.99	.31	5.79
1877	33,575,911	4.50	.96	.30	5.76
1878	33,943,773	4.64	.97	.29	5.90
1879	34,302,557	4.68	.99	.29	5.96

STATISTICS—*cont.*

As to the Non-Alcoholic Drinks of the people of the United Kingdom.

Years.	Population United Kingdom.	Average Consumption per Head of Population. Tea lbs.	Coffee lbs.	Cocoa lbs.	Total lbs.
1880	34,622,930	4.57	.92	.30	5.79
1881	34,931,466	4.59	.89	.31	5.79
1882	35,207,613	4.69	.89	.34	5.92
1883	35,445,918	4.82	.89	.36	6.07
1884	35,717,663	4.90	.90	.39	6.19
1885	36,007,141	5.07	.91	.41	6.39
1886	36,303,660	4.93	.87	.42	6.22
1887	36,586,412	5.02	.80	.44	6.26
1888	36,865,180	5.03	.83	.49	6.35
1889	37,160,446	5.00	.78	.50	6.28
1890	37,464,051	5.18	.77	.54	6.49
1891	37,803,058	5.36	.77	.57	6.70
1892	38,109,329	5.43	.76	.55	6.74
1893	38,440,371	5.41	.69	.54	6.64
1894	38,786,053	5.52	.68	.57	6.77
1895	39,112,865	5.67	.70	.62	6.99
1896	39,464,582	5.73	.69	.61	7.03
1897	39,817,407	5.81	.69	.69	7.19
1898	40,559,954	5.86	.69	.79	7.34
1899	40,909,925	5.98	.72	.83	7.53
1900	41,454,621	6.07	.70	.94	7.71
1901	41,952,510	6.17	.76	1.01	7.94
1902	42,372,556	6.06	.68	1.08	7.82
1903	42,789,552	6.03	.71	.97	7.71
1904	43,217,687	5.99	.65	1.08	7.72
1905	43,659,121	6.03	.71	1.07	7.81
1906	44,100,321	6.18	.77	1.21	8.16
1907	44,100,231	6.20	.84	1.30	8.34
1908	44,538,718	6.18	.83	1.31	8.32
1909	45,008,421	6.29	.84	1.44	8.57
1910	45,469,564	6.31	.80	1.50	8.61
1911	45,216,665	6.53	.80	1.66	8.99
1912	45,360,822	6.47	.79	1.79	9.05
1913	46,035,570	6.64	.78	1.70	9.12
1914	46,407,037	6.84	.81	1.66	9.31
1915	46,431,548	6.87	.92	1.96	9.75
1916	46,431,548	6.55	.79	1.90	9.24
1917	46,431,548	6.02	1.09	2.24	9.35
1918	46,431,548	6.74	1.14	2.79	10.67
1919	46,089,249	8.42	.82	3.19	12.43

NET IMPORTS OF TEA.

(Quantities in lbs.)

YEAR.	EUROPE.			AMERICA.		AUSTRALASIA.	
	UNITED KINGDOM. Calendar year.	‡ RUSSIA. Calendar year.	OTHER COUNTRIES. Calendar year.	UNITED STATES. Year ending 30th June.	CANADA. Year ending 31st March.	AUSTRALIA. Calendar year.	NEW ZEALAND. Calendar year.
1912	308,242,000	151,000,000	33,106,000	100,395,000	35,773,000	35,065,000	7,621,000
1913	307,488,000	167,000,000	32,534,000	93,911,000	37,463,000	35,951,000	7,014,000
1914	303,361,000	172,000,000		90,148,000	34,035,000		9,897,000
1915	365,731,000	184,000,000	Complete figures not available.	92,174,000	37,068,000	*39,467,000	9,099,000
1916	315,359,000	200,000,000		109,075 000	37,745,000	*42,330,000	7,928,000
1917	226,955,000	140,000,000		102,739,000	34,473,000	*37,616,000	9,416,000
1918	461,433,000	20,000,000		147,379,000	55,503,000	*34,182,000	9,477,000
1919	464,817,000	21,000,000	53,000,000	93,057,000	14 212,000	*43,348,000	8,275,000
1920	390,438,000	††	††	91,620,000	29,114,000	††	††

* Year ending 30th June. ‡ Including Asiatic Russia. †† Figures not yet available.

TEA ENTERED FOR HOME CONSUMPTION IN THE UNITED KINGDOM DURING THE YEARS 1910 to 1920.

(Quantities in lbs.)

ORIGIN.	1910	1911	1912	1913	1914	1915	1916	1917	1918	1919	1920*
India	162,504,000	168 744,000	165,298,000	172.844,000	184,793,000	181,799,000	187,937,000	167,305,000	249,609,000	258,814,000	241,553,000
Ceylon	93 370,000	89,119,000	93.529,000	91,518,000	90,679,000	92,571,000	80,981,000	77,249,000	59,731,000	106,400,000	112,061,000
China	10,288,000	14,495,000	10,576,000	9,682,000	13,007,000	12,733,000	8,697,000	16,026,000	812,000	4,428 000	3,585,000
Other Countries	20,916,000	21,143,000	26,006,000	31,646,000	28,998,000	29,711,000	24,418,000	16,856,000	535,000	18,823,000	35,625,000
TOTAL	287,078,000	293,501,000	295,409,000	305,690,000	317,477,000	316,814,000	302,033,000	277,436,000	310,687,000	388,465,000	392,824,000

* Subject to revision.

NET EXPORTS OF TEA.

(Quantities in lbs.)

Year.	India (Years ended 31 Mar.)	Ceylon.	Netherlands, E. Indies. (Gross Exports.)		China.	Japan.
			Java.	Sumatra.		
1912	253,308,220	191,029,387	61,821,393	—	179,160,294	39,851,400
1913	276,148,023	192,176,160	65,075,383	—	162,422 392	34,029,735
1914	284,452,905	195,216,419	71,470,927	471,784	175,178,205	39 475,427
1915	293,685,389	211,629,777	101,815,042	1,327,169	209,535,770	45,316,844
1916	330 520,736	202,482,959	99,956,564	3,791,912	173,836,505	51,124,196
1917	283,345,512	193,033,962	80,395,148	3,401,698	124,161,205	66,893,493
1918	346,684,172	180,638,872	61,137,967	4,907,440	47,183,818	51,427,756
1919	312,017,339	208,433,578	111,610,080	8,719,193	81,260,635	30,934,375
1920	372,949,957	184,816,683	95,102,035	11,040,542	(*a*)	26,437,728

(*a*) Figure not yet available.

STOCKS OF TEA IN BOND IN THE UNITED KINGDOM AT THE END OF EACH MONTH DURING THE YEARS 1910-1920.

(Quantities in 1,000 lbs.)

Month.	1910.	1911.	1912.	1913.	1914.	1915.	1916.	1917.	1918.	1919.	1920.
January ..	134,512	124,880	132,471	136,051	133,872	130,139	150,161	118,207	63,427	132,127	215,175
February ..	129,989	122,562	125,853	129,395	127,768	122,200	118,725	94,441	69,945	147,042	203,061
March ..	122,110	116,043	115,473	121,477	117,377	96,018	96,103	92,577	85,180	157,570	212,645
April	102,058	104,725	100,119	103,272	107,267	73,596	100,013	86,099	85,161	149.671	207,520
May	91,058	87.678	82,447	87,568	87,361	74,041	98,873	86,472	92,957	151,589	221,471*
June	81,626	74,403	73,305	77,099	77,436	75,172	84,508	72,949	91,330	161,561	224,102*
July	80,698	69,281	79,297	72,655	78,959	83,946	84,983	64,793	81,764	143,729	220,172*
August ..	89,976	76,497	96,348	82,223	81,039	90,181	97,018	46,838	84,019	133,138	222,478*
September ..	97,621	89,832	109,002	99,717	83,093	116,419	118,663	34,850	76,011	142,959	220,792*
October ..	109,141	101,709	118,951	112,632	64,544	130,258	127,237	32,131	97,159	145,774	224,814*
November ..	113,922	109.560	132,470	125,434	74,486	148,461	122,873	37,745	122,646	169,861	227,903*
December ..	126,099	128,229	138,492	138,005	117,848	148,196	130,247	37,400	135,295	213,083	220,433*

* Subject to correction.

COPRA.

(*Cocos Nucifera.*)

THE coconut Palm, from which Copra is obtained, is indigenous to a great extent throughout the Tropics, particularly favouring situations in close proximity to the sea coast. From time immemorial it has been a source of prosperity in Ceylon, and in more recent years it has been extensively cultivated in the Malay Peninsula, Phillipine Islands, Dutch East Indies, along the Malabar Coast and in the South Sea Islands, plantations being owned and maintained by Chinese and native planters, as well as by European Joint Stock undertakings. The palms thrive best in flat alluvial land, such as is found near the mouths of rivers. They yield satisfactorily in the dry zones in Ceylon, but in Malaya they absorb much moisture, and appear to produce the best results where there is a rainfall of from 60 to 80 inches per annum.

The Coconut palm attains full maturity in about 25 years, but commences to bear fruit about the sixth or seventh year. The average tree, when in full bearing, produces from 50 to 60 nuts per annum.

The leaves of the Coconut Palm provide roofing material suitable to the climate of the Tropics. From the husk, coir for ropes, mats, brooms, brushes and paper pulp is obtained. The shell is made into lamps, drinking vessels and similar articles of domestic use. The shell also, when burnt, provides a useful charcoal.

The product which has the highest commercial value, however, is the kernel, which, when dried in the sun, or artificially in kilns, becomes the commodity known as Copra. Its value lies in its high fat content, which on the average is over 60 per cent. of the bulk.

The Copra is subjected to treatment by expressing or crushing machinery, which extracts the fat in the shape of Coconut Oil. Some 25 years ago the oil produced from the Copra Crop, which was then only about 120,000 tons per annum, was practically all used in the manufacture of soap and candles. Since then there has been a considerable development in the vegetable fat trade resulting in an enormous demand for butter and other animal fat substitutes and particularly in the development of the Margarine trade. The edible properties of Coconut Oil were immediately apparent, and the result is that to-day practically all the oil derived from Copra is used in the manufacture of Margarine and other edible fats and to such an extent, that in order to meet the demand, production has increased until the annual Copra Crop is now nearly a million tons. This is not apparent in the export figures of Copra from the various producing countries, because during the last few years very large crushing plants have been established in the East, principally in the Dutch East Indies, the Phillipine Islands, Ceylon, and on the Malabar Coast, so that in place of getting the full quantity of Copra from these places, a large quantity of oil is exported instead. The residue, after the oil has been expressed, is made into cake called Poonac, which constitutes an excellent food for cattle.



A COCONUT PLANTATION.

EXHIBITS FROM CEYLON, F.M.S. & STRAITS SETTLEMENTS.

COCONUTS *(cocos nucifera)* with husks complete.

COCONUTS, with half husk shewing the nut embedded.

DO. Section shewing the husk, nut and kernel.

GERMINATED COCONUT as taken from the nursery.

SMALL PLANTS ready for planting out in the Clearings.

LEAVES. Specimen palm leaves (Bot. Spec.)

FLOWERS of the Coconut palm (in spirit).

TODDY. Sample of Toddy made from the flowers.

ARRACK. Distilled product of Toddy.

COPRA. Sun dried.

DO. Kiln dried.

DESSICATED COCONUT. Samples of the various grades.

OIL. Coconut oil as expressed from the Kernels

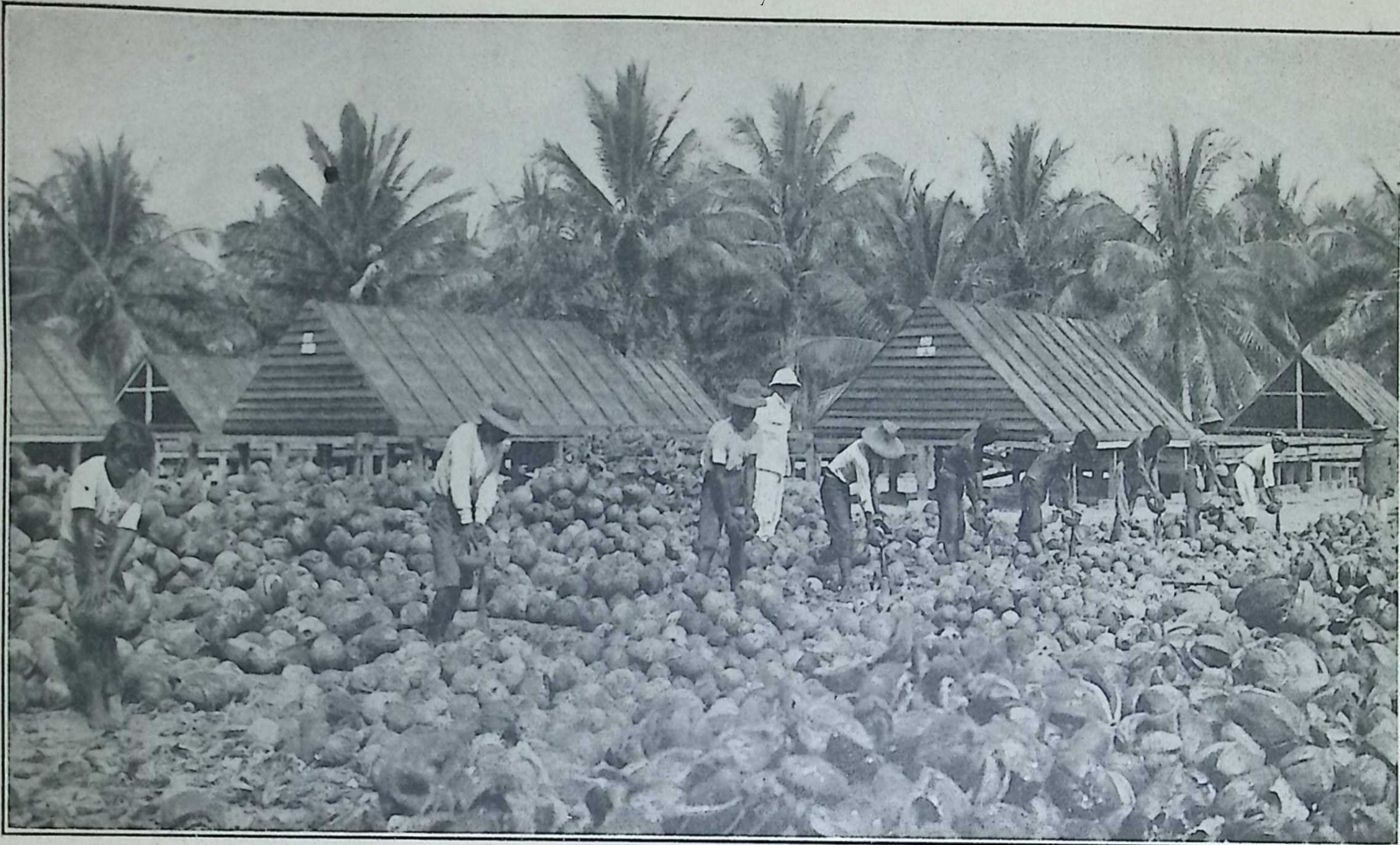
POONAC. The residue after the oil has been extracted.

COIR YARN.	Alapat	Fine Hand twisted.
	Anjengo Aratory Ashtamudy	Wheel twisted.
	Vycome Calicut (unsoaked) Quilandi	Weaving yarns hand twisted.
	Cochin Perpangadi	Roping yarn.

CHARCOAL made from the burnt coconut shell.

MATTING. Rope, brooms, brushes, sacks and other articles of manufacture.

MARGARINE made from coconut oil.



HUSKING COCONUTS.

PHOTOGRAPHS.

JUNGLE showing the dense undergrowth.

FELLING the jungle.

BURNING the jungle after it has been felled and left to dry.

NURSERIES. Showing the young plants ready for planting out.

HOLING AND PLANTING. The distance apart is usually 30 feet by 30 feet.

DRAINING the new clearings.

WEEDING the young clearings.

CULTIVATION. Ploughing and cultivating with Tractors.

MANURING with ash and stable manure.

PICKING nuts with bamboos 30 to 45 feet long with curved knife attached.

PICKING WITH MONKEYS. Monkeys are only used for the very high trees that cannot be reached with a bamboo. The monkey picks about 300 nuts per day.

TRANSPORTING nuts to the factory by buffalo carts.

HUSKING.

SPLITTING nuts before putting them in the Kiln.

DRYING Kernels in Kilns. Below men are removing partly dried copra from the shells.

DRYING Kernels in the Sun. The men are cutting up the copra to facilitate drying.

PACKING Copra for Export.

FACTORY. General view.

DO. Showing Kiln on left and Drying Shed on right.

FACTORY COMPOUND.

TRANSPORT to the Coast.

SHIPPING Copra.

EXPORTS OF COPRA FROM SOME OF THE PRODUCING AREAS IN THE EAST.

(Quantities in Tons.)

	* India.	Ceylon.	British Malaya.	Netherlands East Indies.
1912 ...	34,341	31,426	21,690	176,914
1913 ...	38,176	57,706	22,642	162,814
1914 ...	31,231	73,311	46,636	239,917
1915 ...	15,189	55,134	27,517	172,109
1916 ...	21,427	64,234	18,569	149,850
1917 ...	33,498†	37,522	38,856	114,946
1918 ...	41,490†	58,240	34,126	67,506
1919 ...	15,276†	86,852	57,825	325,488
1920 ...	‡	68,044	‡	‡

* The figures given for India for any year do not refer to the calendar year, but are for the twelve months commencing with the 1st April of that year.

† For the years 1917, 1918, 1919 there was a net *Import* of Copra into India, but there was a great increase in the exports of Coconut Oil during these three years.

‡ Figures not yet available.

COFFEE.

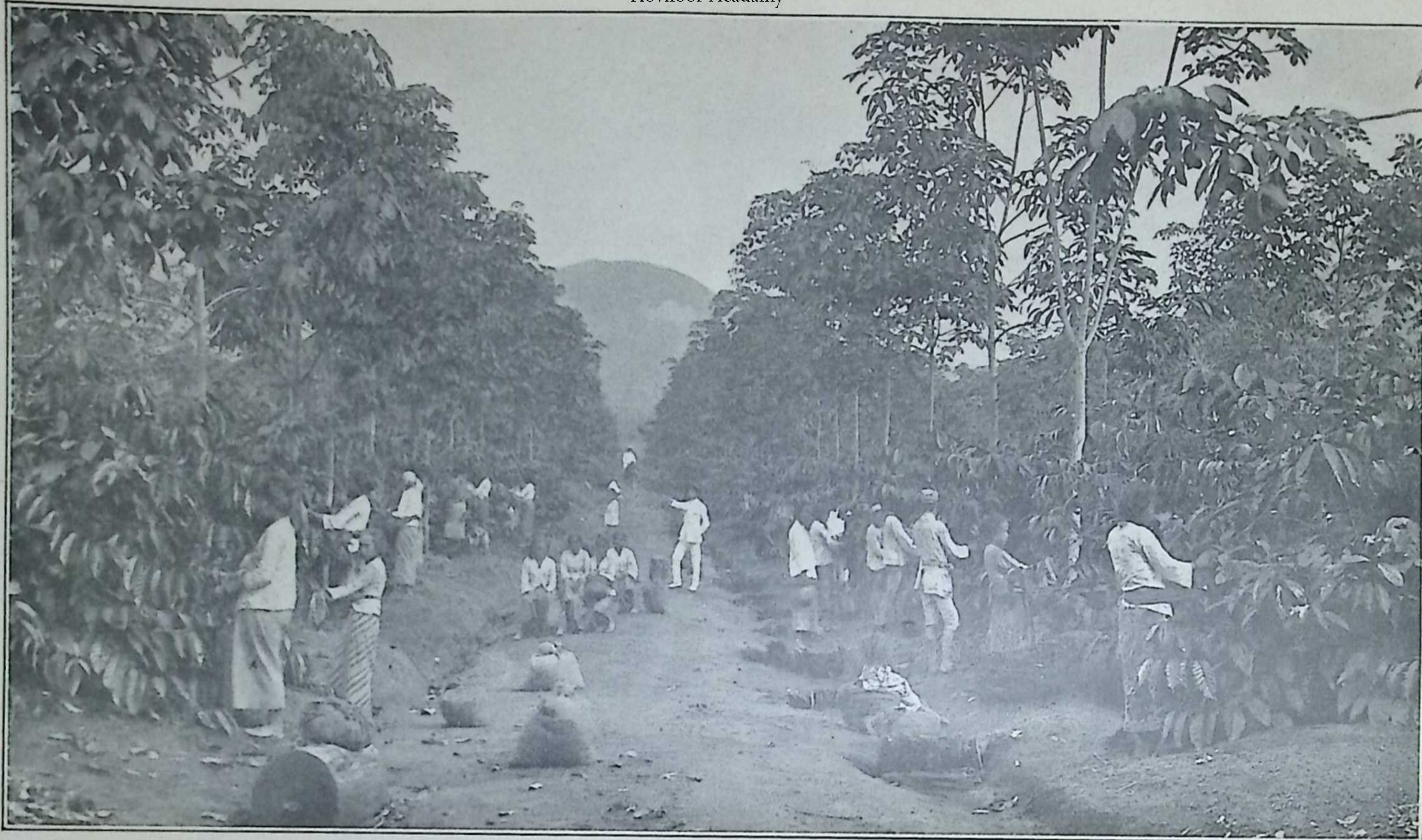
THE main crop of Coffee now harvested in Java is Coffee Robusta. This species has taken the place of Liberian and old Java Coffee, the species cultivated before the plantations were ruined by Leaf-disease in 1880. The prevalence of the leaf-disease induced Planters to seek for a kind of coffee that would better withstand disease, with the result that Robusta Coffee, a vigorous grower and a prolific cropper was introduced into Java about the year 1900. Robusta is also favoured because it comes into bearing about the third year after planting, whereas Arabica and Liberia require respectively one and two years longer.

In 1905 a number of Coffee Growers in Java began to interplant Hevea Rubber in wide avenues in the Robusta Coffee fields. Robusta Coffee so interplanted has been grown with great success in East Java. These East Java Estates have harvested satisfactory crops from the same area first from Robusta Coffee and then from the Hevea Rubber. A few estates have retained the Coffee bushes in the tappable rubber plantations but the closing in of the tops of the Hevea Trees gradually reduces the cropping capacity of the Coffee.

The gathering of the coffee berries is, naturally, done by hand, the first sorting taking place in the factories, where black and unripe berries are removed. While a few plantations, mostly native-owned, adhere to the old-fashioned East Indian process of preparation, drying the coffee in the sun, stamping, winnowing, and unhusking by hand, which turns out an unevenly coloured coffee, the majority of estates prefer the wet or West Indian method. In this case machinery is employed to separate the beans from the pulp, after which the beans are soaked in concrete tanks until they reach the stage when the produce is known as wet parchment coffee. Excess of moisture is then removed by centrifugal driers, and after drying, the parchment skin and the "silver skin"—the inner lining immediately next the bean—are removed in the hulling machine. A final sorting then takes place, after which the coffee is graded and packed in bags of one picul each, ready for shipment.

Robusta when well roasted makes a palatable breakfast coffee, but it is best suited for blending purposes. Experts remark on the gradual improvement in flavour of this Coffee the longer it is cultivated in Java. It would appear that as the bushes get more and more acclimatised to that country, the beans partake of the qualities which made the Liberian and old Java Coffee favoured marks in the Coffee market.

The principal market for Robusta Coffee is on the Continent of Europe, but since 1914 considerable quantities have found their way to the United States of America. It is interesting to note that the consumption of Coffee is being restricted by the inability of the coffee-drinking countries of



A COFFEE ESTATE.

Europe, through post-war financial conditions, to purchase their normal requirements. This would have been a very serious matter for the Coffee Growers had not the main supply of the World's Coffee been curtailed by a disastrous frost in the middle of 1918, which so affected the Brazilian Coffee plantations, that for two to three years they could not produce normal crops. In spite, therefore, of restricted consumption the statistical position of Coffee remains strong, and with easier monetary conditions throughout the world, Coffee Growers would appear to be justified in anticipating a fair measure of prosperity.

EXHIBITS FROM INDIA, CEYLON AND JAVA.

ROBUSTA. Coffee in cherry (in spirit).

LEAVES of the Coffee bush (Bot. Spec.)

FRUIT. Small branch showing fruit (in spirit). Each berry contains two seeds, the Kernels of which are the coffee of Commerce.

COFFEE. Samples of the Coffee bean in the various stages of preparation for the market.

COFFEE. Samples of the various grades of Coffee.

DO. Samples of pure Robusta roasted and ground ready for use.

PHOTOGRAPHS.

JUNGLE shewing the dense undergrowth.

FELLING the jungle.

BURNING the jungle after it has been felled and left to dry.

NURSERIES. Shewing the seedlings ready for planting out.

HOLING AND PLANTING. The distance apart is usually 8 feet by 8 feet.

COFFEE BUSHES. Various ages.
In full blossom.
In full fruit.

PICKING the fruit.

TRANSPORT to the Factory.

MANUFACTURE. Shewing the various processes prior to shipment.

PACKING for shipment.

STATISTICS.

EXPORTS OF COFFEE FROM NETHERLANDS EAST INDIES.

Quantities in 1,000 Kg. = 2,204.6 lbs.

Destination.	1912	1913	1914	1915	1916	1917	1918	1919	1920
				JAVA AND MADOERA.					
Netherlands ...	13.041	10.440	12.101	30.072	21.416	4.350	—	34.660	21.511
United States ...	1.732	1.510	2.795	1.717	515	1.588	750	27.008	7.836
Singapore ...	236	261	322	86	680	3.188	1.084	3.285	3.786
Other Countries ...	10.298	7.693	4.899	2.196	608	4.235	3.606	36.629	10.545
Total	25.307	19.904	20.117	34.071	23.219	13.361	5.440	101.582	43.678
				SUMATRA, BORNEO, CELEBES, &c.					
Total	8.559	5.761	9.119	11.944	7.542	3.022	1.859	21.219	‡
				TOTAL NETHERLANDS EAST INDIES.					
Total	33.866	25.665	29.236	46.015	30.761	16.383	7.299	122.801	‡

The figures for Sumatra are the net exports and do not include the quantities sent to Java, which are included in the Java exports.

‡ Figures not yet available.

TOBACCO.

IN the early sixties of the last century, the Tobacco Merchants of Holland were informed that on the East Coast of Sumatra the soil was suitable for the cultivation of Tobacco, and in 1864 the first sample of tobacco leaf was received on the Rotterdam Market. A few bales followed in 1865, the quality of which found favour. European supervision, with labour imported from China, followed, and in 1874 the crops in Sumatra totalled 15,000 bales. During the next ten years an average crop of 125,000 bales was produced, and in 1895 200,000 bales, whilst the present day yield is about 270,000 bales yearly.

Sumatra Tobacco possesses such a thin silky leaf that it is invaluable as a cigar cover, imparting a flavour which embellishes but does not hide that of the tobaccos composing the finished cigar.

Climate, soil, and rainfall for Tobacco Cultivation, are ideal on the North East Coast of the Island where lies the Deli Plain—the soil is rich in nitrogen, phosphoric acid and lime in Deli and Langkat. These districts extend from the coast to 25 miles inland, and about 50 miles from East to West, and it was here that the early Planters cleared off the heavy virgin forest. To-day all the best land is cleared and has been planted several times, the system being to take off Tobacco crops and then allow the land at least a five years' "rest." Perfect draining is essential, as Tobacco will not thrive on swampy soil.

For rough work on roads, drains, buildings, etc., on Tobacco Estates, Planters employ native and South Indian labourers, Bataks, Banjarese Javenese and Klings (Tamils); and for planting, Chinese imported from Swatow and Amoy.

A great demand is now established in many parts of the world for Sumatra Cover Leaf Tobacco, notably in Germany. The U.S.A. buyers also attend the Annual Sales in Amsterdam, March to July and September to October, in each year, and the competition for good marks is very keen.

EXHIBITS FROM SUMATRA.

Nicotina Rustica.	Seed of the Tobacco Plants originally brought from Java.
Nicotina Rustica.	Specimen leaves of different grades. The leaves are of such a thin silky nature that they are invaluable as cigar covers.



TOBACCO FIELD.

PHOTOGRAPHS.

JUNGLE. Shewing the dense undergrowth.

FELLING the jungle.

BURNING the jungle after it has been felled and left to dry.

CHANKOLLING or breaking up the soil.

PREPARED LAND. Ready to receive the seedlings.

NURSERIES. Shewing seedlings ready for planting out in the Clearings.

PLANTING out the seedlings.

TWO STAGES grown tobacco.

PICKING the Tobacco leaf.

STRINGING the leaves.

DRYING SHED. Exterior.

DRYING SHED. Interior.

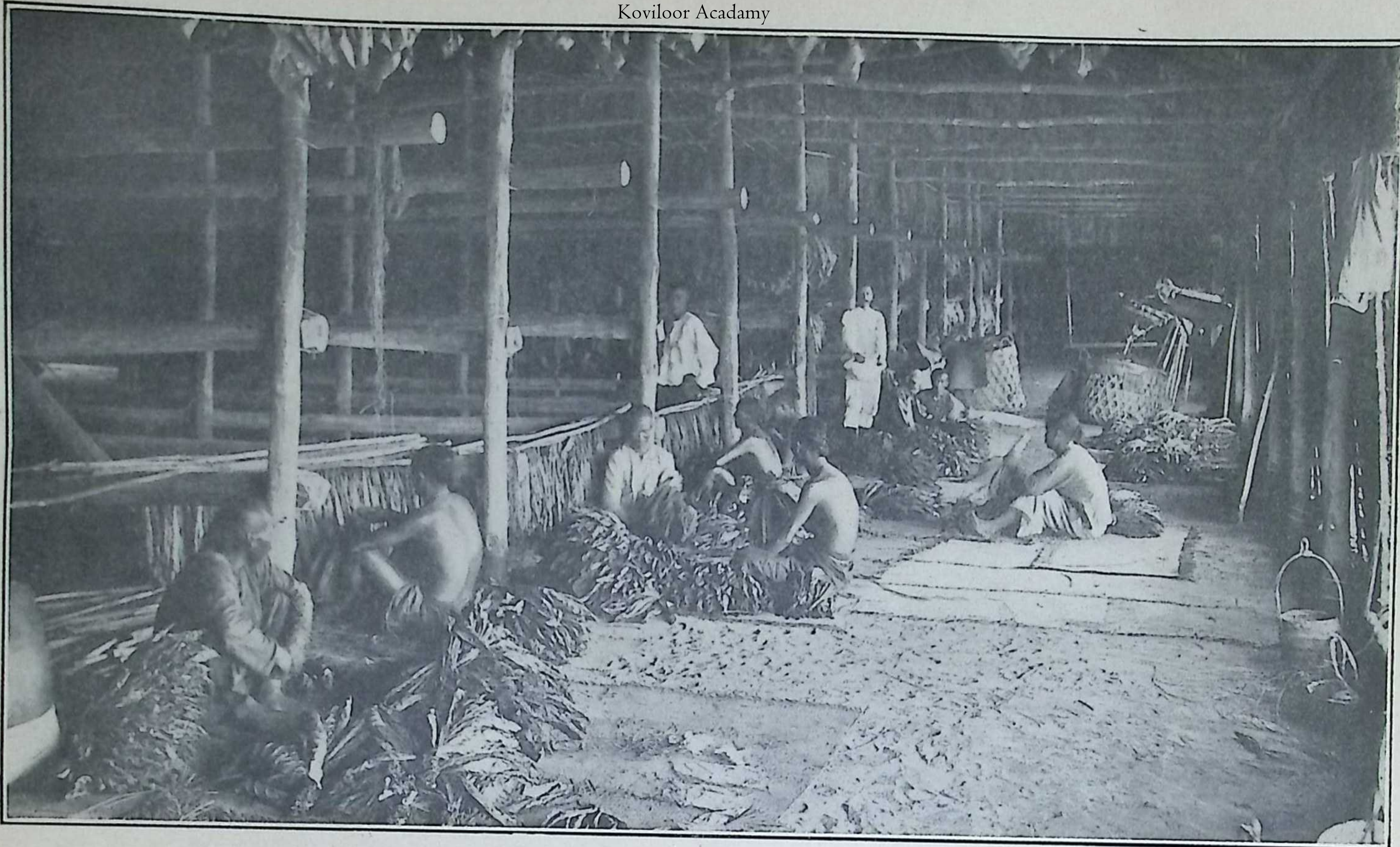
SEED TREES. Grown specially for the production of Seed.

TRANSPORT of leaf to the Fermenting Shed.

FERMENTING. Interior view of Fermenting Shed.

SORTING. Interior view of Sorting Shed.

PACKING the leaf in bales ready for shipment.



"STRINGING" TOBACCO LEAVES.

EXPORTS OF TOBACCO FROM NETHERLANDS EAST INDIES.

(Quantities in 1,000 Kg.=2,204.6 lbs).

JAVA AND MADOERA.

Destination.	1912	1913	1914	1915	1916	1917	1918	1919	1920
United Kingdom ...	—	—	—	—	—	—	—	3.864	2.175
Netherlands	60.848	60.313	48.873	61.373	71.500	5.623	—	75.516	94.169
Europe, other * ...	—	—	—	—	—	—	—	17.755	2.850
United States ...	—	—	—	—	—	497	400	329	374
Straits Settlements ...	287	348	503	459	482	332	194	362	176
Other Countries ...	36	128	53	33	10	792	2.863	974	2.456
Total	61 171	60.789	49.429	61.865	71.992	7.244	3.457	98.800	100.200
	SUMATRA, BORNEO, CELEBES, &c.								
Total	22.703	26.797	17.613	21.480	21.619	5.257	4.590	41.603	‡
	TOTAL NETHERLANDS EAST INDIES.								
Total	83.874	87.586	67.042	83.345	93.611	12.501	8.047	140.403	‡

* Not separately distinguished until 1919.

The figures for Sumatra are the net exports and do not include the quantities sent to Java, which are included in the Java exports.

‡ Figures not yet available.

COAL.

THE Cowie Harbour Coal Company Limited was registered on the 15th November, 1905, and acquired a Concession covering the exclusive rights, for 99 years from 31st October, 1903, to mine for coal over an area of 20 square miles, in the Serudong District of British North Borneo.

About 700,000 tons of coal have been mined to date.

The present output of coal is about 250 tons daily, but the Collieries are equipped to deal with a much larger output and when conditions are more normal, it is expected that arrangements will be made to develop the mines on a much larger scale.

The coal is bituminous. It is a good steam-raising coal, and it is not liable to spontaneous combustion.

The coal is shipped at the ports of Sandakan and Sebattik in British North Borneo. Liners and cargo vessels trading between China, Japan, Java and Australia, frequently call at Sandakan for bunker coal, whilst recently, owing to the revival of the Pacific phosphate trade, several of the well-known ship-owners here have recommenced bunkering their vessels at Sebattik. The coal is also exported in bulk from Sebattik to Singapore, Hongkong and the Phillipine Islands.

The British, French, Japanese and American Navies were bunkered during 1914-1918.

ANALYSIS.

By W. H. BLAKE, F.C.S., of Newcastle-on-Tyne.

	Composition %
Carbon	70.64 (Dry Coal)
Hydrogen	5.62
Oxygen	8.80
Nitrogen	0.85
Sulphur	2.47
Ash	11.62
	100.00

Calorific value: 7416 Calories, or 13,348 British Thermal Units. Compared with Durham Coals such as Townley, this Coal is of a medium quality, the Calorific value is moderately high, and the fusion point is satisfactory. It should give very useful results as a manufacturing or bunker coal.



BORNEO COAL MINE.

TIMBER.

THE British Borneo Timber Company, Limited, was registered on the 23rd January, 1920, to acquire the business of the China-Borneo Company, Limited, which had been established for many years in the Far Eastern timber trade. The Company owns Saw-mills, also an Engineering Works and a Slipway at Sandakan where vessels up to 500 tons can be built or dry-docked for survey or repair. The efficiency of these works is being largely increased by the introduction of modern labour-saving plant and machinery.

This Company has further obtained a concession from the British North Borneo Company for the exclusive right for not less than 25 years to cut timber, for export, on any State Lands (covering about 31,000 square miles) in British North Borneo. It has been estimated that over 150,000,000 cubic feet of merchantable timber is available from areas already located, and it is estimated that the output of timber during 1921 will reach 1,500,000 cubic feet.

BORNEO TIMBER EXHIBIT.

THE SERIAHS (BORNEO CEDARS).

This is a name applied to a large number of soft and light woods with a more or less cedarlike odour. The Seriahs include Seriah (red seriah 'Borneo Cedar'), Urat Mata (white seriah 'Borneo white cedar'), and Madjao.

The wood varies in colour from a very pale pink or grey to a dark red. The terms Red Seriah and White Seriah are often used in the market to distinguish the darker and the lighter forms of Seriah. In the forest these terms are often, if not always, found to apply not to the colour of the wood, but to the reddish appearance produced by the bark and the underside of the leaves. These are the most abundant woods in North Borneo. The wood has a very pretty grain and is easily worked.

WEIGHT.—25 to 40 pounds per cubic foot. Logs float.

SIZE.—Almost any size up to a diameter of 5 feet and a clear length of 80 feet can be obtained.

USES.—The poorer grades can be used for construction, and the finer grades for fine furniture, panels, etc. Some of the finer grades are practically indistinguishable from Oba Sulu (Philipine mahogany.) The better coloured and figured pieces of Seriah make very acceptable substitutes for Mahogany, in panels, veneers, etc.



BORNEO TIMBER.

KRUIN (BRUNEI TEAK).

It is a moderately hard and moderately heavy, coarse-grained, dark reddish-brown wood, with distinct sapwood and heartwood. The sapwood is relatively small in amount and very light in colour. It contains a considerable amount of an oleo-resin, the Minyak Kruin, which is used medicinally and for caulking boats.

WEIGHT.—40 to 55 pounds per cubic foot. About half of the logs will sink, when freshly cut.

SIZES.—Clear lengths of 80 feet or more and diameters up to 4 feet are common.

USES.—A strong and stiff wood, suitable for general construction work, when not in contact with the ground. In a tropical climate it will decay when placed in water or in contact with the ground. If used in the proper surroundings and painted, it is very durable. Its abundance, cheapness, and the ease with which large dimension material can be obtained will probably some day cause it to become the most important structural wood of the country. Very good cheap furniture can be made from it. When cut in narrow strips it makes very good flooring.

KAPOR OR BORNEO CAMPHOR WOOD.

Wood moderately hard and moderately heavy, straight-grained, of a brownish-red colour; with a camphorlike odour when freshly cut; sapwood and heartwood distinct, the former whitish or yellowish and needing to be removed before the wood is used.

WEIGHT.—48 to 50 pounds per cubic foot. About 50 per cent. of the logs will float when freshly cut.

SIZES.—Logs 4 feet in diameter and 80 feet long can be obtained.

USES.—The wood is very good for all classes of construction, except where it is placed in water or in contact with the ground. It is sometimes used for furniture and is recommended for trial in the making of gunstocks.

Camphor oil and crystalline camphor are obtained from the wood and are used medicinally.

BILLIAN OR BORNEO IRON WOOD.

Wood dark brown, very heavy, very hard, very durable; rather straight-grained and splitting readily. Sapwood yellowish and scanty in amount. The wood becomes very much darker in colour after prolonged exposure to the air.

WEIGHT.—60 to 70 pounds per cubic foot. Logs sink.

SIZES.—The trunk is often ridged. It is often 2 feet in diameter and 75 feet in height. Fairly abundant and well distributed. Can be used advantageously in logs of as small a diameter as 12 or 13 inches.

USES.—This is the best known and most esteemed Borneo wood, because of its very great durability, strength, and its ability to withstand changes of moisture and temperature. It is remarkably resistant to the attacks of teredo and insects. It is the best wood for salt-water piling, wharf construction, house posts, or wherever great durability is required. It is one of the strongest woods known.

SELANGAN KACHA (PRIME AVERA OR BORNEO GABOON).

The wood is pale yellow, soft, light to moderately heavy, straight-grained with little distinction between sapwood and heartwood. Common and widely distributed.

WEIGHT.—39 pounds per cubic foot. Logs float.

SIZES.—Up to 5 feet in diameter, with 80 feet clear length.

USES.—Construction, light furniture and interior finish.

SELANGAN BATU (BORNEO TEAK).

It is a very hard and heavy, to very heavy wood, yellowish brown when first cut but rapidly darkening on exposure to the air, showing a very glistening surface in transverse section; strong, elastic, quite durable, breaking with a long splinter.

WEIGHT.—52 to 65 pounds per cubic foot. Logs sink.

SIZES.—Logs up to 4 feet in diameter and 60 feet long can be obtained. The supply is abundant.

USES.—All kinds of construction work, heavy framing, sleepers, flooring, and wherever durability and strength are required. One of our best woods.

OBA SULU (BORNEO MAHOGANY).

This is a dark red, fine-grained, soft to moderately hard, light to moderately heavy wood, with distinct sapwood and heart-wood, being more durable, finer-grained, more suitable for furniture, and slightly heavier and harder.

WEIGHT.—40 to 45 pounds per cubic foot. Logs float.

SIZES.—Often 2 to 4 feet in diameter, of good shape and with clear lengths of 60 feet or more.

USES.—The wood is suitable for furniture, panelling, etc. It is a satisfactory substitute for Mahogany in many kinds of work. This wood is not abundant. The bark is scaly, reddish brown, and is used for dyeing.



TRANSPORTING TIMBER.



THE AERIAL ROPEWAY.

MIRABAU (BORNEO No. 1 TEAK.)

A very hard and very heavy, coarse-grained, dark yellowish brown wood, with sulphur yellow deposits.

The commoner and heavier form grows inland on flat land or on river bottoms, and is one of the best known woods.

WEIGHT.—48 to 75 lbs. per cubic foot. Logs sink.

SIZES. Up to 5 feet in diameter and with 50 feet clear length. Not abundant.

USES.—A very strong and durable wood, very resistant to insect attack, but not suitable for use in salt water. It is used for all kinds of high-grade construction, and is an excellent wood for fine furniture.

PENAGAH.

A moderately hard and moderately heavy brownish wood with remarkably twisted grain, a very finely figured wood. Will not split. Very scarce. Its export was formerly prohibited.

WEIGHT.—45 to 50 lbs. per cubic foot. Logs float.

SIZES.—One and a half feet in diameter and in short lengths not exceeding 12 feet.

USES.—Very much prized for the ribs of boats, also for furniture, and wherever a wood is required that will not split.

TIMBER TESTS.

Professor C. A. Middleton Smith, Dean of the Faculty of Engineering, University of Hongkong, has made tests of the more important timbers in the University Laboratory. Six samples each of Selangan batu, Billian, Mirabau, Camphor, Oba Sulu, Urat Mata, Kruin, Selangan Kacha and Red Seriah cut from seasoned stock and measuring 2 inches by 2 inches by 3 feet were forwarded to Professor Smith. These samples were for use in obtaining the co-efficient of bending strength, and later samples of the same woods cut 3 inches by 3 inches by 9 inches were forwarded for use in compression tests. The method used in the bending tests is that known as the "third point loading" in which the load is distributed over the middle third of the specimen. This method approximates conditions under which timbers are loaded in ordinary use. The co-efficient of bending strength (f) was determined from the equation :

$$f = wl/bd^2$$

The following tables gives the average results obtained :—

Name of Wood.	Mean average co-efficient of Bending Strength (six specimens).
Selangan Batu	8.06 tons per square inch.
Billian	7.29 " " " "
Mirabau	6.77 " " " "
Camphor	4.93 " " " "
Oba Sulu	4.88 " " " "
Urat Mata (White Seriah) ...	4.57 " " " "
Kruen	4.45 " " " "
Selangan Kacha	4.24 " " " "
Red Seriah	3.54 " " " "

The results obtained for the same species in compression are as given in the following table:—

Name of Wood.	Crushing Strength average of 6 specimens (tons per square inch).	Highest Figure of 6 specimens (tons per square inch).	Lowest Figure of 6 specimens (tons per square inch).
Billian ...	4.99	5.59	4.45
Selangan Batu	3.89	4.06	3.71
Mirabau	3.57	3.72	3.40
Camphor	2.47	2.65	1.99
Oba Sulu	2.41	2.64	2.20
White Seriah	2.28	2.54	1.94
Kruen ...	2.17	2.79	1.38
Selangan Kacha	1.95	2.14	1.82
Red Seriah	1.63	1.78	1.53



THE RAILWAY.

STATISTICS.

The official returns issued by the State of North Borneo shew that the total output of timber cut in British North Borneo during 1919 amounted to 1,776,983 cubic feet, of which 1,496,126 cubic feet was cut from Government land, and the remainder, viz., 280,857 cubic feet, was cut from private land.

The timber cut from Government land was produced as under :—

	cubic feet.
China-Borneo Company, now The BRITISH BORNEO TIMBER CO., Ltd.	1,104,650
Other Companies	391,476
Total ...	1,496,126

The following figures relate to the importation at Liverpool of Cedar only, but the figures for Borneo cover all imports from Borneo and are not imports only from the British Borneo Timber Company :—

	1919. Super feet.	1920. Super feet.
Imported from Borneo	81,000	472,000
„ other places ...	477,000	247,000

NOTE.—The small quantity imported from Borneo during 1919 was due to the difficulty of transport.

FURNITURE.

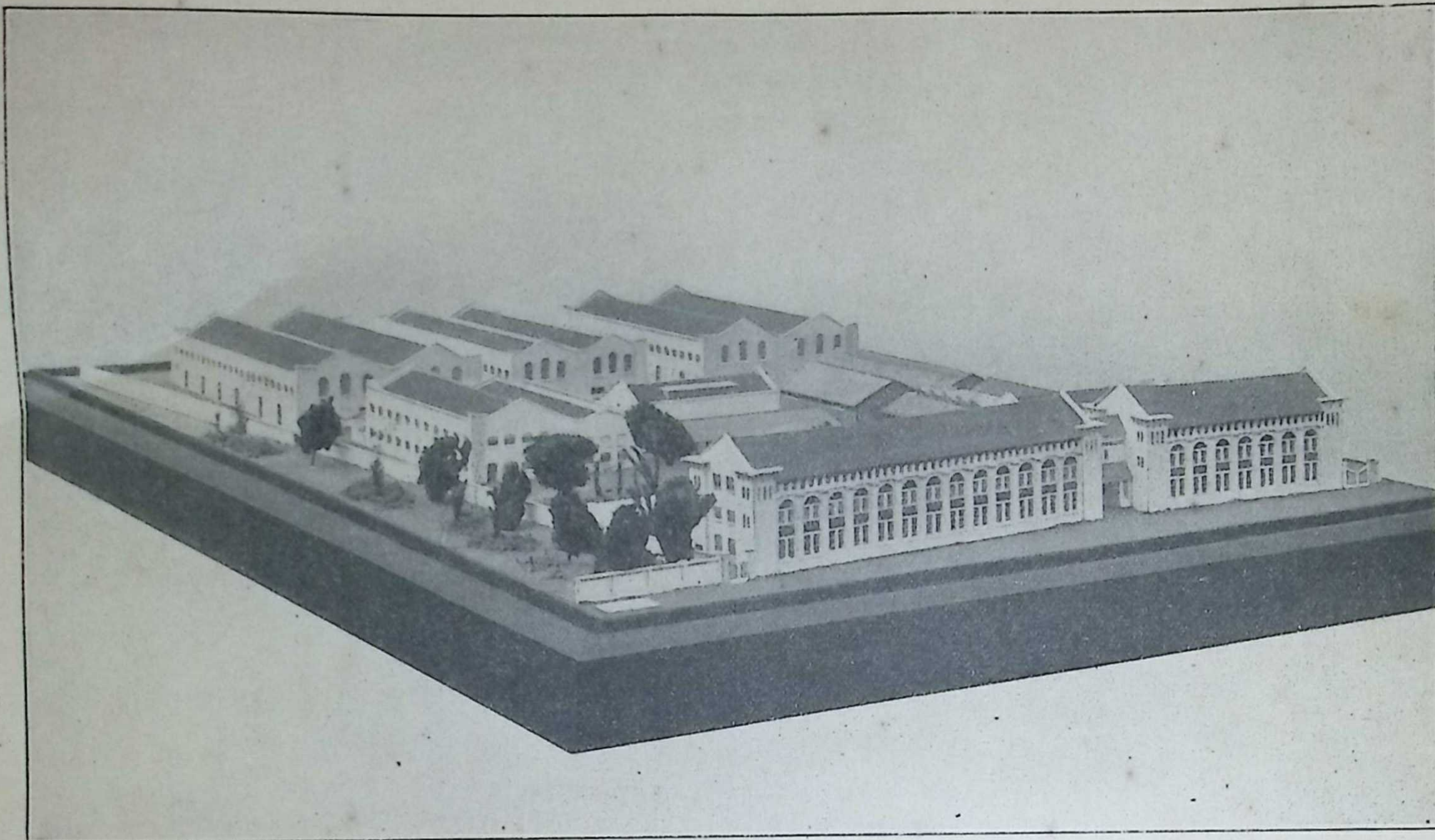
FROM INDIA AND BORNEO.

MANUFACTURED BY HARRISONS & CROSFIELD, LTD.,—QUILON—S. INDIA.

Table desk (Blackwood)
Pedestal writing Table (Blackwood)
Typists table (Teakwood)
Arm chairs (Blackwood)
Bookcase (Blackwood)
Single hall cupboard (Teakwood)
Board Room Screen (Teakwood)

MANUFACTURED FROM BORNEO TIMBER (Selangan Kacha—Cedar)

Table desk
Typists table
Bookcase
Arm chair
Revolving chair
Filling Cabinet



MODEL OF H. & C. MILLS, COLOMBO.

TILES AND BRICKS.

MANUFACTURED BY HARRISONS & CROSFIELD, LTD.,—QUILON—S. INDIA.

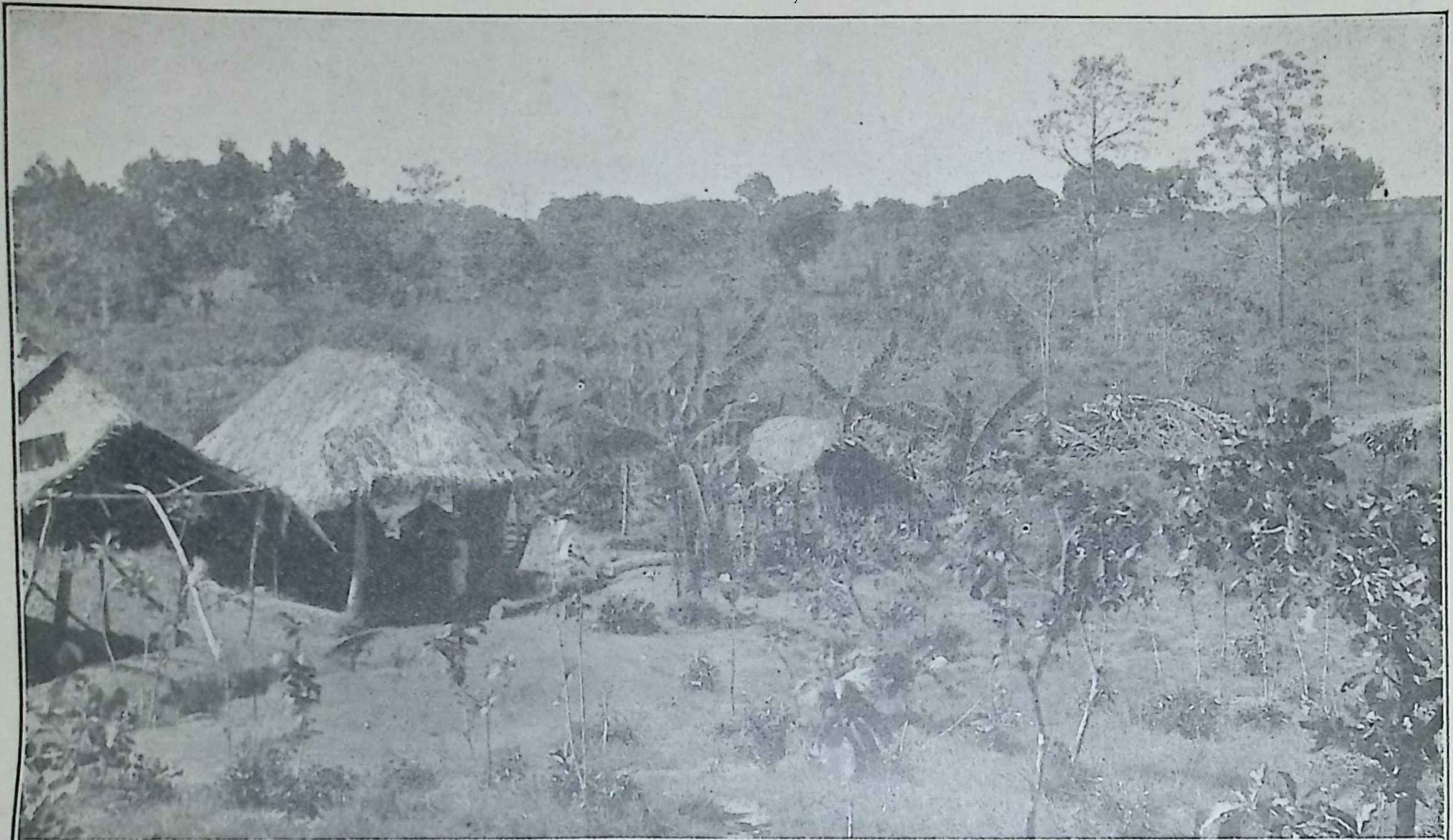
Roofings ; Lion Brand.
Roofings ; Elephant Brand.
Ridges ; ,,
Valleys ; ,,
Roofings ; Flat Ry. Pattern.
Roofings ; D.P.W. Pattern.
Terrace ceilings.
Ceilings to go under roofings.
Face bricks.
Wire cut bricks.
Floorings 9 by 9
,, 7½ by 7½
,, 9 by 6
,, 6 by 6

TEA LEAD.

MANUFACTURED BY HARRISONS & CROSFIELD, LTD.,—COLOMBO—CEYLON

Lead Sheets	12 ins. by 12 ins.	2 oz.
,,	12 ins. by 12 ins.	2½ oz.
,,	12 ins. by 12 ins.	3 oz.
,,	12 ins. by 12 ins.	3½ oz.
,,	12 ins. by 12 ins.	4 oz.

Model of Harrisons & Crosfield, Ltd. Mills—Colombo.



LEMON GRASS STILL.

SUNDRY PRODUCTS.

EXHIBITS.

AJWAN SEED. (*Carum Copticum*). The source of the valuable antiseptic Thymol. The liquid distilled from the seeds known as 'omam water' is largely used as an essential oil. The percentage of oil in the seeds is very low and usually does not exceed 3 or 4 per cent. One of the bye-products is Thymene which is a cheap scent utilised in the manufacture of soap.

BETEL NUTS. (*Piper Betel*). The fruit of the Areca palm is commonly used throughout Ceylon, India, and Malaya as a masticatory. Also in the preparation of dentrifices and for tanning. Yield per tree approximately 250 to 300 nuts per annum.

Green.
Dried.
Implement for cutting nuts.

CARDAMOMS. (*Elettaria Cardamomum*) used in flavouring Curries and confectionery and in England as a drug.

Green.
Sun dried.
Sulphur Cured.
Oil of Cardamoms.
Seeds.

CASTOR SEED. (*Ricinus Communis*). The seeds after picking are semi-dried and husked and are then ready for market. The oil content is about 40 per cent. A good deal of the country pressed oil is retained for home consumption as a lubricant and an illuminant. Large quantities are also used for dressing leather.

CHILLIES. (*Capsicum*). The pods are sun-dried and when reduced to powder become the red pepper or cayenne of commerce.

CINCHONA. (*Succirubra or Ledgeriana*). The valuable curative effect of quinine in Malaria Fevers was first made known in 1638 when the drug was administered to the Countess of Cinchon, wife of the Viceroy of Peru after whom the plant was named.

Bark.
Root.
Quinine (powder).
Quinine (liquid).

<u>CINNAMON.</u> (*Cinnamomum Zeylanicum*). The tree is coppiced and the bark stripped off the young wood and dried in quills. Thicker pieces of bark from the larger shoots are sold as chips.

Chips.
Quills.
Cinnamon leaf oil.

<u>CITRONELLA GRASS.</u> (*Ceymbopoogu Nardus.*) A fragrant essential oil is distilled from this plant.

<u>CLOVES.</u> (*Eugenia caryophyllata*). Cloves are unexpanded flower buds which are plucked when they assume a bright scarlet color and are thereafter dried in the sun. The approximate yield per tree is 6 to 7 pounds dry cloves. A valuable essential oil is obtained from the cloves which is largely employed in perfumery.

<u>COCOA.</u> (*Theobroma Cacao*). An average crop is 50 pods per tree but certain trees under very favourable circumstances may bear as many as 400 to 500 pods. Each pod contains on an average 32 to 35 beans or seeds and 15 average pods may be expected to yield 1 pound of made cocoa.

<u>CORIANDER.</u> (*Coriandrum Sativum*). The seeds yield a spice and a volatile oil while the leaves are eaten as a vegetable and form an ingredient in curries.

<u>COTTON SEED</u> (*various*). The seed is not decorticated before crushing. The oil content is only 15 to 18 per cent.

<u>CUMMIN SEED.</u> (*Cuminum cyminum*). Used as a flavouring in confectionery and curries. The equivalent of caraway (*cavum carui*) seed used in England.

<u>CUTCH.</u> (*Acacia catechu*). The tree is felled and the heart-wood cut into chips and boiled until the fluid attains the consistency of syrup. A ton of wood contains 250 to 300 pounds of Cutch.

<u>DIVI-DIVI.</u> (*Caesalpinia coriaria*). The pods contain a very high tanning content.

<u>GINGER.</u> (*Zingiber officinale*). On the Malabar Coast, which has for long been famous for its ginger, cuttings are planted in May and the rhizomes are dug up the following November. The rhizomes are sold either green or dried. 2,000 pounds per acre is considered a fair average yield.

<u>GROUND NUT.</u> (*Arachis hypogaea*). Until recent years the method of decorticating was to damp the ground nuts and beat them with sticks to separate the brittle shells from the Kernels, a method which involved much damage to the latter. Further, once the kernels have been wetted they are liable to discoloration and fermentation and the oil produced is rancid. The use of machinery which can shell the nuts in a dry state is therefore becoming more popular. The oil content of the shelled kernel is about 40 per cent.



PEPPER VINE.

HEMP. (*Cannabis sativa*). The fibre is obtained by wetting the stems in water, bruising with stones, and resoaking until the fibre strips off easily. Average yield is from 500 to 800 pounds per acre.

INDIGO. (*Indigofera arrecta*). Yields the well known dark blue dye of commerce.

KAPOK. (*Eriodendron aufractuosum*). Largely used for stuffing pillows and mattresses and owing to its lightness, for filling life belts.

KARDI SEED. (*Carthamus tinctorius*). The seeds of the plants when crushed yield larthamus oil, the percentage of oil in the seed being about 25. The oil is used as dubbin to prevent leather from hardening on exposure to damp. The flowers of the plant are used for the extraction of safflower dye.

LEMON GRASS. (*C. flezuosus*). The oil distilled from the grass is used for scenting fine soaps and blending with perfumes.

LINSEED. (*Linum usitatissimum.*) Cultivated entirely for its seed. The plant is identical with the flax of Europe, but having long been cultivated for its seed only is sown much more sparsely. A fair average yield may be taken as 300 pounds per acre. The oil content of linseed varies from 37 to 43 per cent.

MACE. (W. Indian). Mace is used chiefly as a spice, sometimes in medicine and perhaps a little more often as a flavouring agent. It contains only a small percentage of oil which is colourless, but very fragrant and is always in good demand.

MOWRA SEED. (*Bassia.*) The seeds contain a large quantity of edible oil which from the ease with which it solidifies is often called "mahua butter." It is largely used all over India as a ghi substitute or adulterant, but mainly in the manufacture of soap and candles. A spirit which is a favourite drink is distilled from the flowers.

MYROBALANS. (*Terminalia chebula.*) A valuable tanning agent. The best qualities of seeds are oval and pointed and solid in structure, while the less valuable are round and spongy. The seeds are crushed and the concentrated extract containing 50 to 60 per cent. of tanning is usually shipped in solid blocks.

NIGER SEED. (*Quizota abyssimica*). The normal yield per acre is 300 pounds, and the oil content 35 per cent. Most often seed is locally crushed and used for cooking, anointing the body and mixing with other oils.

NILGHERY CANES.

Natural.
Polished.

NUTMEGS. (W. Indian) (*Myristica*). As is well known the main use of nutmegs is as a spice. The oil content, about 8 to 10 per cent. of the bulk, is obtained by distillation of pulverised nuts. Oil of Nutmeg is used for scenting soap.

NUX VOMICA. (*Strychnos nux vomica*). Seeds of a deciduous tree, the source of the alkaloids strychnine and brucine.

OIL PALMS. Palm oil is used extensively for the manufacture of soap and candles and also in the preparation of margarine.

Specimens of Oil Palm fruit preserved in spirits.
Palm Kernels from which the oil is expressed.

PALMYRA FIBRE. *(Borassus flabelli formis).* Natural graded No. 1.
" " 2.
" " 3.
Bassine.

PEPPER. (*Piper Nigrum*). The berries when of a reddish colour are picked and spread in the sun, when they become black and shrivelled. These when ground with the outer covering left on form "Black Pepper." When deprived of the black covering by maceration in water they make "White Pepper."

POPPY SEED. *(Papaver Somniferum.)* The plant is grown principally for the opium derived from it. The average yield per acre is 4 cwt. A great deal of poppy seed is consumed as food and the oil is widely used for culinary purposes. The oil content is about 30 per cent.

RAPE SEED. (*Brassica compestes*). The oil obtained from Rape Seed amounts to between 42 to 45 per cent. of the bulk. This oil, known as Rape Seed Oil, is commonly used in India for cooking purposes and by Hindus to anoint the body. The residue, rape seed cake, is utilised as Cattle fodder and also for manurial purposes.

SESAME. (*Sesamum indicum*). This is variously known to the trade as til, teel, gingelly or sesame and yields a valuable oil. A fair average yield is 300 pounds per acre. The oil content is approximately 40 per cent. Used principally in India for cooking purposes and as an illuminant or for anointing the body.

TODDY PALM. (*Caryota Urens*). From the young flower raceme is obtained, a sweet sap which is boiled and fermented. The sap is then distilled and becomes an intoxicating spirit known as arrack.

TURMERIC. (*Curcuma longa*). Cultivated on account of its rhizomes which are edible and also yield a valuable dye. The yield per acre varies from two to four thousand pounds.

PHOTOGRAPHS.

LEMON GRASS OIL.	Coolies plucking wild grass.
	Exterior of native still.
	Interior of native still.
PEPPER.	Clusters of berries of pepper vine.
	Coolies plucking the berries.
NUX VOMICA.	Garbling and sorting.
	Weighing and packing.

ESTATE SUPPLIES

HARRISONS & CROSFIELD, LTD. (Export Dept.)

1/4, Great Tower Street, E.C. 3.

GOUGES—BENT END AND SWAN NECK. $\frac{1}{4}$ inch to $\frac{5}{16}$ inches wide—used for tapping rubber. This is the favourite tapping tool in the F.M.S. and Straits Settlements, and is used to a considerable extent in Java.

—STRAIGHT. $\frac{1}{4}$ inch to $\frac{5}{16}$ inch—used in Java to a small extent.

JEBONGS. (Named after the Jebone Estate in Perak). These tapping tools vary considerably as regards shape and size. They are used both as draw and push knives. Three very popular patterns are exhibited, viz.—

(1) The "Serdang" perfected by us after years of experience as to angle and width of cutting edge, clearance, method of grinding, and strength of blade. This tool is used almost exclusively in Sumatra, and is steadily increasing in popularity in Java and Borneo.

(2) The "Kuala." A light tool of the same type, popular in the F.M.S. and S.S.

(3) "Baby Jebong." A still smaller type of Jebong, used in the F.M.S. and Borneo.

FARRIER KNIVES. A selection of various shapes and sizes is shewn. This was one of the first forms of tapping implements used, but has been superseded by the Gouge and Jebong on most Estates.

PATENT TAPPING IMPLEMENTS. The specimens included in our Exhibit are used chiefly in Ceylon and Southern India.

TEA PRUNING KNIVES. The shape and size of these knives vary considerably according to the country in which the knives are used and the age of the plants to be pruned.

CHANGKOLS. The Changkol or Digging Hoe is the spade of the East. It is used for planting, weeding, draining, road-making, &c. The shape, size, weight and method of manufacture vary according to the country in which it is used. We shew:—

(1) Round Eye Changkol used in the F.M.S., S.S., and Borneo

(2) Stirrup Eye Changkol used in the F.M.S., S.S., and Borneo.

(3) In-steeled Changkol, Men's Pattern, used in Sumatra.

The blade of this Changkol is made of moderately mild iron or steel, with a layer of hard steel through the centre. This method of construction ensures a sharp cutting edge being maintained as the outside layers of soft metal wear away quicker than the hard steel centre. Hoes are sometimes made with a steel face on an iron blade, which has the same effect when the tool is in use, the wear taking the same form as the wear of the human tooth.

The eyes of these Changkols are welded to the blade to enable the handle to be set at an angle to the blade to suit the height of the user.

A lighter implement of the same type is used by the female labour force in Sumatra.

MAMOTTIES. A similar implement to the round eyed and stirrup eyed Changkol mentioned above. The name "Mamottie" is used in Ceylon and S. India.

PARANG. A similar implement to the Sumatra Changkol, but smaller. This tool is used in Java for the same purposes as the Changkol and Mamottie.

MALAY PARANG OR CHOPPING KNIFE. Used in the F.M.S., S.S., Sumatra, Java and Borneo for the same purposes as a Bill-hook is used in England.

SOCKET PARANG AND PARANG BENGKOK. Used in Sumatra and Java for clearing undergrowth, etc.

CEYLON CATTIES. Used in Ceylon and Southern India for the same purpose as the Parangs above mentioned.

SORROCK OR WEEDING HOE. Used in Sumatra.

SODOK. An implement used on Estates for transplanting purposes.

AXES. American or Yankee Axe. (Weight 3½ to 4½ pounds.) Used for felling trees throughout the East. The name American applies to the shape of the tool. These tools are largely manufactured in England.

JAVA AXES AND CEYLON AXES. A light type of Axe (weight about 2¼ to 3¼ pounds) used for clearing. All these Axes are manufactured with both round and oval eyes to suit the requirements of the various districts in which they are used.

ALAVANGOES OR PITTING BARS. Used in India and Ceylon for digging holes for transplanting purposes.

DIGGING FORKS. A specially heavy fork used on Tea Plantations in Ceylon and Southern India. This fork is heavily constructed with a T handle, and is used by the natives with both hands. The tool is driven into the soil and shaken, not lifted in the method of application in Europe.

LATEX COLLECTING CUPS. For catching the Latex as it flows from the tapped tree.

ALUMINIUM LATEX CUPS. Used in Ceylon, South India and Java.

WHITE EARTHENWARE LATEX CUPS. Conical shape. Used in all rubber growing districts in the East.

GLASS LATEX CUPS. Conical shape. Used in all rubber growing districts in the East.

GLASS HALF-LEMON SHAPE LATEX CUPS. Used in all rubber growing districts in the East.

The glass and earthenware cups are frequently marked with the names of the Estates on which they are used in order to avoid pilferage.

ENAMEL LATEX BUCKETS. Used in collecting latex from the cups.

SEAMLESS TIN STEEL LATEX CANS. Used for transporting the latex from the Plantation to the Factory.

SPOUTS. Made of galvanised iron and used for directing the flow of Latex from the tapped channel into the collecting cup, the base of the spout being inserted into the bark of the tree.

LATEX STRAINERS. Made from Gauze, and used for removing chips of bark and foreign matter from the Latex.

ENAMELLED COAGULATING PANS. Used for coagulating Latex preparatory to making into sheets.

ACETIC ACID. This acid is diluted with water and used for coagulating the Latex.

SODIUM BISULPHATE. Used in the process of coagulation, for the purpose of preventing discolouration of the rubber.

CARBOLINIUM HEVEAUM. A special preparation used as an insecticide and fungicide on rubber plantations.

BELTING.—

CURIOS.

INDIAN NATIVE WOOD CARVING illustrating various Trades, Castes etc.

TODDY TAPPER climbing a Coconut Tree. Caste—Ezhuva. Local Name—"Chethukaran."

TODDY TAPPER AND WIFE. Caste—Ezhuva. Local Name—"Chethukaran."

ASTROLOGER AND WIFE. Caste—Kandiyan. Local Name—"Kandiyan."

NATIVE OIL PRESS and oil mongers at work. Caste—Vaaniyan. Local Name—"Vaaniyan."

FISHERMAN AND WIFE on way to market. Caste—Marakkan. Local Name—"Marakkan" and "Marakkathie."

NATIVE FISHERMAN AND BOAT. Caste—Marakkan. Local Name—"Maram."

MAHAMADAN AND WIFE. Caste—Travancore. Local Name—"Methan" and "Ummachi."

ADIYAN AND WIFE. Low caste hill tribe—Hunters and Cultivators of Paddy.

POLAYAN AND WIFE. Low caste manual labourers.

SAWYERS AT WORK. Local Name—"Arrapukaran."

PLOUGHING.

CHINESE FISHING NET as used in the back waters of Cochin.

BULLOCK COACH. Local Name "Petty Vandy" or "Mena Vandy."

CABIN BOAT. Model of Boat used by H.H. The Maharaja of Travancore on State occasions.

"OADY." Model of racing boat as used on Malabar Coast.

CURIOS—Cont.

INDIAN IVORIES AND SUNDRY ARTS.

Ivory elephant tusker paper weight.
Ivory brooch.
Ivory Gods.—Sri Krishnan.
,, ,, playing flute
,, ,, ,, ,, in guise of a Shepherd.
,, ,, killing the snake.
Ganapathi.
Brahma, with three heads and six hands.
Carved and mounted coconut shell.
Sandal wood paper knife.
Ivory paper knife.
Blackwood ash-tray inlaid with silver.
Blackwood photo-frame inlaid with silver.

Lent by Mr. Chas. Ruxton, Hopton, Ceylon.

Brass lizard.
Carved coconut shells.
Kandiyan chief.
Ebony elephant.
Double bullock cart.
Native fishing boat. (Catamaram).
Nest of tailor bird.
Saw fish.

Lent by Mr. R. C. Vernon, Unugalla, Ceylon.

Carved coconut shell tobacco box.
Kandiyan box, silver and copper work.
Kandiyan tray, silver and copper work.
Brass jewel box.
Antique bangles.
Elephant carved out of coconut wood.
Singhalese fan made from paddy.
Jewel box made of porcupine quills.

Lent by Mr. A. C. Morrell, Kaliyar, S. India.

Thali (N. Malabar).
Thali (S. Malabar).
Native necklace.
Nose ring.
Arc Thadi.
Talepot hat.
Native earrings.

Lent by Mr. J. Mackie, Quilon, S. India.

Set of Indian Ivory Gods.

Lent by Mr. H. J. Welch, London.

Wallam—Indian native boat (S. India).
Brass bowl on ebony elephant (Ceylon).
Brass water jug (Malay).
Brass cup (Malay).
Incense burner (Malay).
Betel nut bowl (F.M.S.)
Brass bottle (F.M.S.)
Native shield (F.M.S.)
Wooden water bottle (Sumatra).
Water carrier (Sumatra).

Lent by Mr. J. A. Gwynne, Chundale, S. India.

Imitation custard apple.
Sandlewood çasket.

Lent by Mr. H. O. A. Waller, Lockhart, Travancore.

Jungle knife carried by Tamils for protection against wild beasts.
Iron ring worn on toes by Tinnivelley natives to protect them against Devil action.

Lent by Mr. A. F. Campbell, Calicut, S. India.

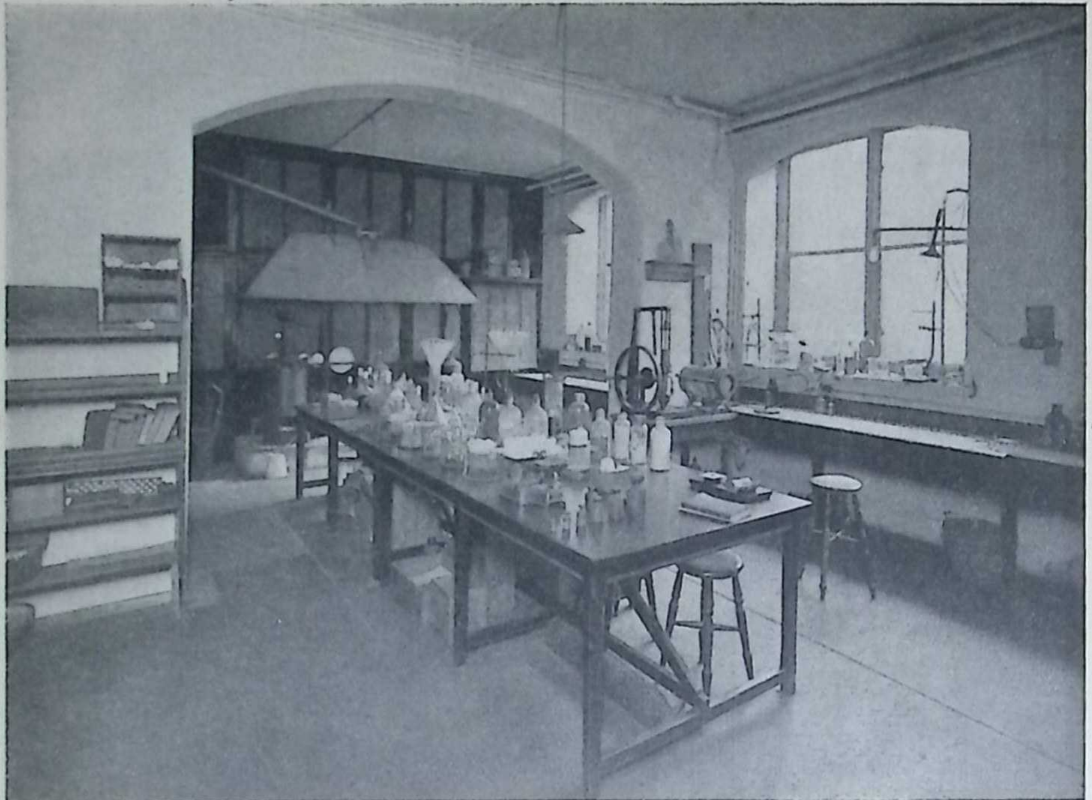
Carved ebony cigarette box.
Quilandy brass bowl.

Lent by Mr. T. P. Gauld, Achoor, S. India.

Double bullock transport cart.
Single bullock transport cart.
Covered passenger boat.
Open passenger boat.
Coconut oil mill.
Double water lift for irrigating paddy fields.
Single water lift for irrigating paddy fields.
Palghaut grass mat.

Lent by Mr. Eric Macfadyen, London.

Selection of Malay silverware.
Specimens of Padang (Sumatra) hand weaving.



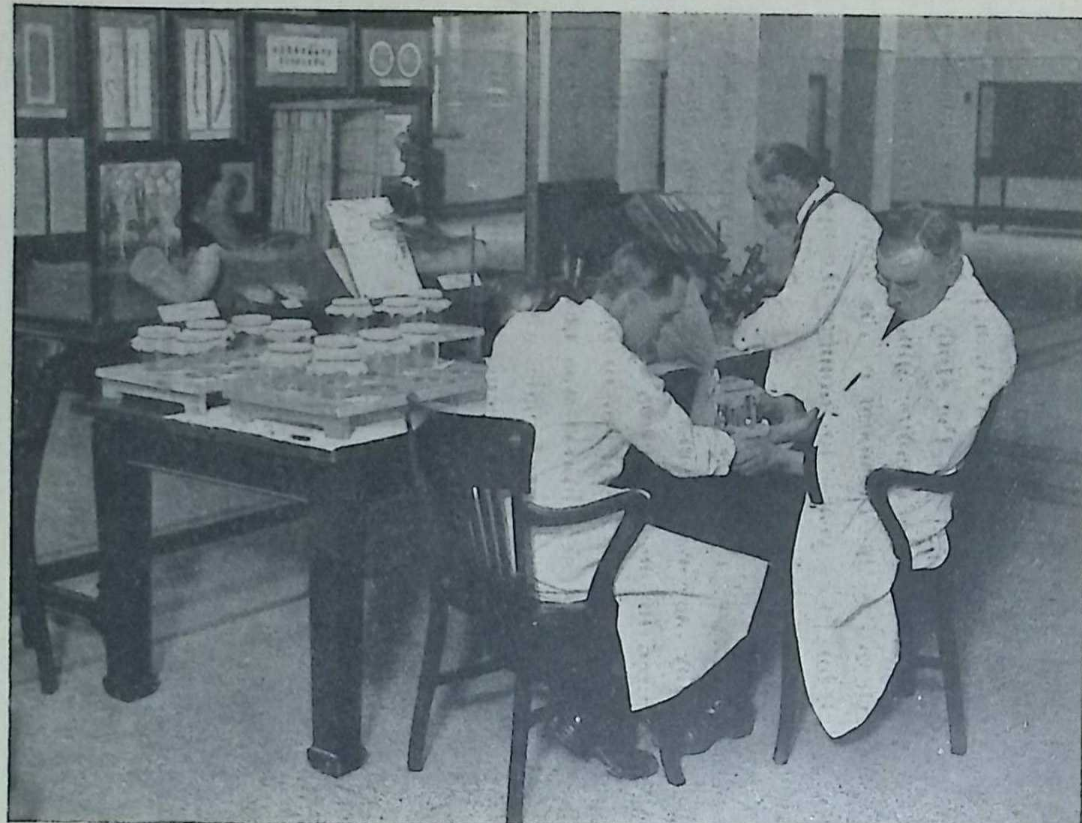
LIVERPOOL TROPICAL SCHOOL LABORATORY.

LIVERPOOL SCHOOL OF TROPICAL MEDICINE.

The Liverpool School of Tropical Medicine was founded in 1898 by the late Sir Alfred Lewis Jones, K.C.M.G., a prominent Liverpool ship-owner, who, fired by an appeal for the study of tropical diseases issued by the late Rt. Hon. Joseph Chamberlain, then Secretary of State for the Colonies, offered to the President of the Royal Southern Hospital the sum of £350 for three years, to promote the special study of such diseases.

The early history of the Liverpool School is a record of struggle ; it was not founded by the Government, as was the London School ; it had no grant, no assured income, nor even, at first, Government recognition. The School early turned its attention to research, and in the Summer of 1899 the first of its expeditions was despatched to Sierra Leone. During the next fourteen years funds were collected to equip and maintain more than thirty expeditions to various tropical regions, including West and Central Africa, Brazil and the West Indies.

In the meanwhile, at home the School was enlarging its scope and consolidating its position. In 1900 the Government gave it full recognition by placing it on the same terms as the London School with regard to newly-appointed medical officers and their courses of training, and four years later further recognition was received in the form of a financial grant from the Colonial Office, which grant was later increased and has continued to the present day. In 1901 a Lectureship and Fellowship were founded, in commemoration of the work of the late Walter Myers, who died of yellow fever in Brazil while serving with the Fourth Expedition. Major Ross was appointed to the former, and the latter was filled by Dr. J. E. Dutton, who, four years later, died in the Congo while investigating tick fever. In 1903 the Alfred Jones Chair of Tropical Medicine was founded, the first holder being Major Ross, while Dr. J. W. W. Stephens, who had joined the staff in the previous year, was appointed to the vacant Walter Myers Lectureship. In 1905 another important Lectureship was founded, namely, that of Economic Entomology, which was accepted by Mr. R. Newstead, of Chester. As the work and influence of the School increased, many new appoint-



FEEDING MOSQUITOES.

ments were made, so that now, at the age of twenty two, the School has three University Chairs,* namely, Tropical Medicine, Entomology and Parasitology, filled by Professors Stephens, Newstead and Yorke, respectively, assisted by a staff of eight Lecturers.

In 1903 the School moved into new laboratories, and in the following year a Diploma in Tropical Medicine was instituted.

In 1904 the Runcorn Research Laboratories were established for the purpose of conducting investigations on the large collection of trypanosomes and other protozoa, which had been collected by members of the expeditions on various occasions. These laboratories were first placed in the charge of Dr. Wolferstan Thomas, and during their ten years' existence much valuable research was done there.

In 1906 was issued the first number of the *Annals of Tropical Medicine and Parasitology.* This publication had been preceded by a series of twenty-one *Memoirs,* mostly reports of the School's expeditions

In 1911 the Yellow Fever Bureau came into being with Dr. Harald Seidelin as Director. As the name implies, the Bureau was established for the purpose of promoting the study of the many problems surrounding this disease. A journal was issued, the *Yellow Fever Bulletin,* of which three volumes were published.

Clinical instruction to students of the School had formerly been given in a special ward at the Royal Southern Hospital. This hospital being at some distance from the laboratory, arrangements were subsequently made with the Royal Infirmary for the erection of a new tropical ward in the Infirmary grounds. The ward, which contains ten beds, with an adjoining clinical laboratory, was opened in 1914.

On the arrival of the fifteenth (Yellow Fever) Expedition at Manáos in 1905, it was found necessary for the work of the Expedition to establish a laboratory of a more or less permanent character. The Manáos Research Laboratory remained in existence until January, 1909, when, owing to the return of its Director, Dr. Wolferstan Thomas, to Liverpool, it was closed. In June, 1910, Dr. Thomas returned to Manáos and opened the present laboratory. In 1914 it was decided to extend the activities of this branch of the school; the outbreak of war, however, caused all developments to be deferred until 1919, when three research assistants were appointed to the laboratory.

* A fourth Chair, that of Tropical Diseases of Africa has now (1921) been established and is held by Professor B. Blacklock.



PLAGUE INVESTIGATION.

The new laboratories of the Liverpool School of Tropical Medicine were formally opened on 24th July, 1920, by Lord Leverhulme, Honorary Vice-President and former Chairman of the School.

The building had been placed, in 1915, at the disposal of the Military authorities for the purposes of a hospital, and was used by them until 1919, for the treatment of patients suffering from tropical diseases, mainly malaria and dysentery. The hospital, which consisted of about 200 beds, was under the charge of Lieut-Col. J. W. W. Stephens, R.A.M.C., Professor of Tropical Medicine, and during its four years' existence more than 3,000 cases were admitted.

Subsequent to evacuation by the Military authorities, the decoration and equipment of the laboratories were put in hand, and to-day the School affords excellent conditions and facilities for instruction and research.

The laboratories are situated in the University grounds, and close to the Royal Infirmary, in which the School has its Tropical Ward and adjoining clinical laboratory. In addition to the basement, which contains the Photographic Department and large storage rooms, there are four floors. The ground floor comprises the Lecture Theatre, with accommodation for about seventy students ; the Library, where, besides text-books and miscellaneous scientific publications, over one hundred current medical journals from all parts of the world can be consulted ; and the Museum, a spacious room, 80 feet by 69 feet, with preparation room adjoining. On the first floor are the Departments of Tropical Medicine and Entomology, the latter with its library of specialised literature, and six research rooms. The second floor comprises the excellently lighted class laboratory, 69 feet by 58 feet, and four research rooms devoted to the Department of Parasitology, while the third floor has a large research laboratory and two smaller research rooms. On the roof are an Insectarium, a mosquito-proofed house, and the animal houses.

With a view to carrying on research work in tropical medicine, the School desired to establish a permanent laboratory on the West Coast of Africa. Funds were available, through the munificence of the late Sir Alfred Jones, and a suitable site on Tower Hill, Freetown, Sierra Leone, having been placed at the disposal of the School by the Colonial and War Offices, the laboratory is now in course of erection.

MALARIA.

By Prof. J. W. W. Stephens, M.D., F.R.S.
LIVERPOOL SCHOOL OF TROPICAL MEDICINE.

HISTORICAL REVIEW.

1847. Meckel recognised that the dark colour of the organs in persons dead of malaria was due to pigment.

1848. Virchow stated that this pigment occurred in blood cells.

1875. Kelsch recognised the frequency of melaniferous leucocytes in the blood of patients suffering from intermittent fever.

1880. Kelsch concluded that malaria could be diagnosed by this sign.

1880. Nov. 23 Laveran announced to the French Academy of Medicine the discovery of the malaria parasite.

1881. Richard in Algeria confirmed this discovery.

1883. King maintained that malaria was transmitted by mosquitoes.

1885. Marchiafava and Celli showed that the parasites could be inoculated from man to man.

1885. Golgi described the cycle of evolution in the blood of the quartan parasites.

1886. Metchnikoff showed the relationship of the parasite to the sporozoa.

1892-1897. Pfeiffer Schaudinn, Seidlecki and Simond evolved the idea of the existence of sexual forms among the sporozoa, and the last two observers observed the act of fecundation.

1893. Smith and Kilborne shewed that Piroplasma, a parasite of cattle, was transmitted by ticks. This was the first known example of an "insect" borne disease.

1894. Manson enunciated the hypothesis that the "flagellating bodies" (forms of the malaria parasite) set free in the stomach of the mosquito developed further in water when the mosquito died.

1897. MacCallum discovered the process of fecundation in halteridium, a "malaria" parasite of birds.

1898. Ross showed that Proteosoma, a malarial parasite of birds, was conveyed by mosquitoes.

1898-1899. Grassi, Bignami and Bastianelli succeeded in infecting man with malaria by means of mosquitoes from malarial regions.

1900. P. Manson, Jun., and Rees infected with malaria in London by mosquitoes sent from Italy.

1901. Anti-malarial measures at Mian Mir, Punjab. No practical result.

1902. Anti-malarial campaign at Ismailia by quinine and antilarval measures. In 1902, 1,551 cases. In 1905, 37 cases (relapses.)

1902-1905. Anti-malarial campaign at Klang and Port Swettenham, Malay States. 1901, 610 cases, 1905, 23 cases.

MALARIA.

Malaria is due to the presence of minute parasites (Protozoa) which live in the red blood cells. They live at the expense of the red cell and grow in size. After a time they split up into a number of young parasites (spores). These in their turn attack other red cells and so the parasites multiply in the body. When a sufficient number has accumulated, an attack of fever is produced at the time when the parasites split up (sporulate), probably by some poison they set free.

Malarial fever usually shows three classic stages, viz.: cold stage, hot stage, and sweating stage, yet in the tropics this division is frequently not at all pronounced.

COLD STAGE. A chill sets in as a rule violently, the teeth chattering and the whole body shaking, but on the other hand there may be only slight shivers. The skin is pale and the extremities cold. It is important to note that already the patient's temperature is elevated, and this may occur some time before the chill. After an hour or so ensues the

HOT STAGE. The face is flushed, the eyes injected, there is a sensation of burning heat, and the temperature has now risen to 104°—5° F. Headache and vomiting add to the patient's distress. After three or four hours there follows the

SWEATING STAGE. Slight, or profuse, wetting the patient's clothes, the previous distress giving place to one of relief and some exhaustion; this stage lasts from two to four hours.

ENLARGEMENT OF THE SPLEEN. This is commonly one of the most important signs of malaria. The longer the disease lasts, the larger and harder it becomes, and in malaria regions this is one of the simplest tests for determining the prevalence of malaria. (Spleen Index.)

PIGMENTATION. The parasites make a black pigment from the red cells on which they live. It occurs either in the parasites themselves or in white blood cells which have ingested it. Pigmentation of the organs is equally characteristic of the disease.

There are three species of malarial parasite known.

PLASMODIUM MALARIAE. This parasite produces quartan fever. The parasite completes its growth in 72 hours, so that fever occurs every fourth day when the spores are set free. The temperature curve rises rapidly and falls rapidly, the paroxysm lasting from 6 to 12 hours.

PLASMODIUM VIVAX. This parasite, producing benign or simple tertian fever, completes its growth in 48 hours so that the fever returns every third day. The rise of temperature is rapid and the fall is rapid, the paroxysm lasting 6 or 8 to 12 hours.

PLASMODIUM PRAECOX. This parasite produces malignant tertian fever. It is one of the commonest in the tropic. The parasite takes 48 hours to develop, but it is peculiar in that sporulation is not completed in a few hours, as in the previous cases, but the paroxysm lasts from 24 to 36 hours, and it is especially with this parasite that irregular continued fevers occurs. The cold stage in this fever is often only very slightly pronounced, and the sweating stage also is not so regular.

It is in the case of this last parasite that pernicious types of fever occur, of which the comatose is the most dangerous.

CHRONIC MALARIA. A condition in which the febrile attacks are slight and often disregarded by the patient, together with anaemia, earthy-coloured skin, enlarged spleen.

MOSQUITO CYCLE. Besides the asexual forms of the parasite which cause the fever, sexual forms also occur in the blood. These male and female forms pass into the stomach of an Anopheline mosquito when the latter sucks blood. Here the male parasite fertilises the female, the resulting parasite being called a Zygote. This passes through the epithelium of the stomach of the mosquito and encysts in the muscular layers. Here it grows, and eventually in its interior multitudes of fine, thread-like bodies are produced—Sporozoites. The cyst containing these ruptures and the sporozoites find their way to the salivary glands of the Anopheline. From here they pass into the blood when the mosquito bites a patient, and become the forms which give rise to fever. This cycle in the mosquito takes from 10 to 14 days, and it is again in another 10 to 14 days after being bitten that the patient gets an attack of fever.

Of the numerous species of Anopheline known, only a very few have been so far proved to actually convey malaria, and we actually know in the case of one very common Anopheline, *Myzomyia rossii*, that it does not convey malaria. In Africa, *Myzomyia funesta* and *M. costalis* are well known carriers, and in India *M listoni*, *M. culicifacies* and *Neocellia stephensi* are the principal ones.

ANOPHELINES are distinguished from other mosquitoes (Culicines) by the fact that in both sexes the palpi are as long as the proboscis. They nearly always have spots on the wing, and by this characteristic and by their attitude they are most commonly recognised. Their attitude is "awl-like,"—that is, their proboscis and body are in a straight line, whereas other mosquitoes (Culicines) are always "humped-backed."

BREEDING PLACES. These are most diverse in character, depending very largely upon the particular species of Anopheline. Thus some prefer muddy pools, cattle foot marks, semi-dry ditches, or small collections of dirty water, and in the case of one or two species the larvæ are found only in the water contained in rot-holes in trees. Others prefer the banks of weedy streams, rivers, canals, rice fields, springs, wells, and fresh water, but speaking generally there is hardly any collection of water, if Anophelines are hard pressed, in which they will not breed. The whole cycle of life, from egg, larva, pupa, to insect, is, under favourable conditions of food and temperature, passed through in 12 days.

LENGTH OF LIFE. This is not known, but certainly extends to several months.

FLIGHT DISTANCE. This is also not known, but they can certainly "drift" for a mile or so.

MALARIA RESERVOIRS. Although it was known, of course, that Anophelines were infected by cases of malarial fever, yet this was not sufficient to explain the great danger of contracting malaria in certain regions. Research, however, led to the discovery that the native children, though apparently in robust health, contained parasites (and sexual forms, i.e. gametes) in their blood. It is especially the young children, 5 to 10 years old, that are infected. They form the great source of infection, and for this reason a native village is an extremely dangerous place to sleep in without adequate protection by a mosquito net.

PROPHYLAXIS. Several methods are available.

(1) Quinine. The method has been successfully used in Italy and elsewhere.

The term Quinine prophylaxis unfortunately is used in two senses; (1) In its true sense, protection against infection, and (2) protection against a recurrence of an already existing infection. This might be called meta-prophylaxis.

(2). Mosquito destruction. By drainage and on a minor scale by the use of larvicides such as petroleum, cresol, formaldehyde, etc., larvæ are destroyed.

(3). Segregation of Europeans. This has been very frequently carried out where possible, as it is the native children that are the great source of infection. Separation of European cantonments or settlements from native bazaars or villages is desirable on this and on general hygienic grounds. It is of especial advantage in small communities on tea plantations, &c., where often other measures are difficult or would at least take time.

PERSONAL PROPHYLAXIS. (1) The use of an oblong mosquito net, hung inside the poles and tucked under the mattress and provided all around above the mattress with a protective piece of calico a foot in width to protect the limbs, is indispensable.

(2). Quinine Prophylaxis. One of the simplest methods is to take 5 grains of quinine every day and 10 grains on Sundays with unfailing regularity, but though some such routine is in common use, unfortunately there is no scientific evidence that infection can be averted by this means.

DIAGNOSIS. There is only one certain method of diagnosis, viz., finding the parasites in the blood.

TREATMENT. Quinine will "cure" an attack, but it will not "cure" the disease, *i.e.*, free the body completely from parasites.

BLACKWATER FEVER. The majority of authorities are agreed that this is dependent on malaria for its production. It appears to be true that it never occurs except in those who have malaria. Hence it may be said that if a person takes the trouble to protect himself adequately from malaria he will never have blackwater fever.

J. W. W. STEPHENS.

MOSQUITOES AND MALARIA.

By Major E. E. Austen, D.S.O., British Museum *(Natural History)*.

Malaria is a disease of man caused by extremely minute parasites, belonging to the lowest grade of the animal kingdom (the protozoa), which live in the red corpuscles of the blood.

Formerly malaria was thought to be contracted by breathing the air of marshy districts, but it is now proved to be due to parasites transmitted from man to man by the bites of certain kinds of mosquitoes. Although about a thousand different kinds of mosquitoes are known, only mosquitoes belonging to the genus *Anopheles*, and only certain species of that genus, are capable of conveying malaria parasites to man. The parasite multiplies not only in the human blood, but also in the wall of the stomach of the mosquito. In the latter, the products of multiplication eventually take the shape of countless, active, needle-shaped germs, which pass through the salivary glands into the proboscis, and so infect a healthy man bitten by the insect.

About one hundred kinds of *Anopheles* are at present known to exist (although the number of different species in any given region is only a fraction of this total), out of which some thirty, at least, are regarded as proved malaria-carriers. Like all mosquitoes, they breed only in water, the breeding-place chosen by most kinds of *Anopheles* being clear fresh water, generally containing an abundance of green alga or other vegetation, at the margins of streams and pools, or in swampy ground. The preliminary stages (egg, larva, pupa), passed through before the perfect mosquito makes its appearance, are the same as in all other mosquitoes, but both egg and larva exhibit certain striking characters, which enable them to be distinguished at once from the corresponding stages in non-malarial mosquitoes. Thus, the eggs, which are laid singly, in groups, or in long rows known as 'ribands,' are provided with air-sacs causing them to float horizontally on the surface ; the chief distinctive characters of the larvæ are noted below.

Anopheles mosquitoes can be distinguished from others as follows :—

(1.) Their position when at rest: in this condition the whole body extends *in a straight line* at an angle with the surface on which the insect is resting, whereas in the case of other mosquitoes the body-line is bent, owing to the more rounded or "humped" shape of the thorax, and the body as a whole is roughly parallel to the supporting surface.

(2.) In the great majority the wings are more or less spotted, whereas in most other mosquitoes they are not.

(3.) In the female *Anopheles* the feelers (palpi) on each side of the proboscis are as long as that organ itself, but in the female of most other mosquitoes they are much shorter.

(4.) Most mosquitoes, when examined under a microscope, are seen to have the abdomen covered with scales like those on a butterfly's wing, but in nearly all *Anopheles* these scales are absent.

(5.) The larvæ of *Anopheles* when at rest lie parallel with and touching the surface of the water, being held to the surface-film by a number of remarkable rosette-shaped tufts : the breathing organ is small, and somewhat saucer-shaped.

Other mosquitoes have larvæ which hang head downwards in the water when at rest, and have no rosettes, but on the other hand have the breathing organ developed into a tube.

In measures for the local suppression of malaria, anti-mosquito work is of primary importance. Such work should include :—

(i) The total abolition wherever possible, by drainage or filling-in of all mosquito breeding-places within at least half-a-mile of habitations.

(ii) The removal, where such abolition is impossible, of all vegetation growing in the water of breeding-places, especially such as is close to the banks ; keeping the water constantly free from all growth of this kind ; smoothing the banks at the water's edge by means of spade-work (training), in such a way that the banks where they meet the water stand nowhere at an angle less than 45° ; canalising small streams, so as to prevent the formation of pools, however small, of stagnant or semi-stagnant water.

(iii) The periodical application to the water of breeding-places of oil or other larvicide.

(iv) The removal from the vicinity of dwelling-places of all bushes, tall grass and other vegetation, which serves as shelter for mosquitoes.

(v) The screening of all doors and windows of inhabited quarters with wire mosquito-gauze. In the case of doors, it should be noted that efficient protection can only be afforded by the provision of a *porch*, which, besides having a self-closing mosquito-proof door at each end, should be not less than 10 feet in length.

By means of procedure on the above lines, conspicuous success has been achieved in many parts of the world, notably in the Isthmus of Panama, during the construction of the Canal.

The case exhibited by the British Museum (Natural History) displays, by means of enlarged models, the different stages in the life-history both of a malarial mosquito and of the parasite of tropical (malignant tertian) malaria.

The exhibits are as follows:—

Enlarged model (X28) of a group of eggs of the Spotted Gnat (*Anopheles maculipennis*). The eggs float on the water either singly or in groups; they are not attached to any object, and are easily scattered by the wind.

More highly enlarged model (X65) of a single egg of the Spotted Gnat (*Anopheles maculipennis*), showing the pair of air-sacs which enable it to float horizontally.

Enlarged model (X28) of the larva of the Spotted Gnat (*Anopheles maculipennis*). The larva rests horizontally at the top of the water. When feeding, it twists its head half-way round, and laps the surface of the water for minute vegetable organisms; if alarmed, it strikes down into the water with a rapid jerking movement.

Enlarged model (X28) of the pupa of the Spotted Gnat (*Anopheles maculipennis*). The pupa rests with the two horn-like air-tubes on the thorax at the surface of the water, but can swim rapidly by jerking the abdomen, which is provided at its extremity with two-paddle like organs.

Enlarged model (X28) of the female Spotted Gnat or Mosquito, in attitude of rest.

Ditto., in attitude of flight.

Models (enlarged 6000 diameters) showing the life-history of the malarial parasite.

A. In human blood.

Exotospore (sporozoite), or malarial germ, as introduced into the blood of man by the bite of a malarial mosquito.

Exotospore after entry into a red blood corpuscle.

Growth of the Exotospore into an Amœbula; the black granules are derived from the hæmoglobin, or red colouring matter of the corpuscle.

Division of the Amœbula within the corpuscle to form Enhæmospores.

Liberated Enhæmospores.

Enhæmospores after entry into a red blood corpuscle.

Growth of the Enhæmospore into a Crescent at the expense of the corpuscle.

Fully-formed crescent.

B. In the Mosquito.

(Crescents appear to undergo no further development in man, but if infected blood be sucked by a mosquito they undergo sexual changes).

Male Crescent.

The male Crescent enlarges, and becomes spherical.

Female Crescent.

The Female Crescent develops into a spherical Ovum (Egg-cell), which after extrusion of the polar body, is ready for fertilization.

Several projections appear upon the surface of the male cell. These lengthen, and are finally set free as motile Spermatozoa. The remaining central part, or Spermatophore, plays no further part in the life-history.

Fertilization of the Ovum by the Spermatozoon.

The fertilized egg or *Zygote* takes nourishment, grows, and becomes the active, motile Vermicule.

After boring through the stomach wall of the Mosquito, the Vermicule becomes spherical, and enlarges considerably.

Further stage of enlargement, the protoplasm broken up into spore-mother cells. (Only one half of the sphere is modelled.)

Sphere at its maximum of development. (Only one half is modelled.) The interior is occupied by countless needle-shaped spores or germs which, on the bursting of the sphere, escape into the various organs of the body of the mosquito.

Sketch of the Stomach of an *Anopheles* Mosquito (X40), showing numerous spheres or cysts studded over its outer surface.

Motile Spores (Sporozoites or Exotospores) liberated by the bursting of the sphere. Such of these as find their way to the salivary glands escape through the ducts of these glands to the proboscis, and are transferred to the blood of man when the mosquito bites.

Specimens of various species of Malarial Mosquitoes, from the Oriental region.

NOTE.

Ever since the vital importance of insects as transmitters of some of the most formidable diseases of the Tropics and elsewhere first began to be realised (now nearly a quarter of a century ago), the British Museum (Natural History) has done its utmost, both by the accumulation and investigation of specimens, and the dissemination of information, to increase existing knowledge of the subject to the full extent of its power.

Its collections of Mosquitoes, Tsetse-flies and other disease-carrying insects are the most extensive in existence, and are at all times at the service of students; while its publications, all of which are copiously illustrated, include monographs, handbooks and pamphlets on noxious insects belonging to various groups, as well as instructions for their collection. It may be added that the Central Hall of the Museum contains a special series of enlarged models (on the lines of those contributed to this Exhibition) of insects associated with disease.

Specimens of injurious insects, whether carriers of disease or plant-pests, from any part of the world, if collected and forwarded in the prescribed manner, will always be gratefully received by the Museum, and so far as possible any desired information concerning them will promptly be supplied.

PHENOMENAL YIELD OF THE LARGEST ORIGINAL PLANTATION RUBBER TREE.

(Shown in the illustration on page 13).

The annual yields of this tree, certified by the Superintendent of the Henaratgoda Botanic Gardens, Ceylon, were as follows:—

95 lbs. dry rubber in 1909.
55 lbs. dry rubber in 1910.
67 lbs. dry rubber in 1911.
86 lbs. dry rubber in 1912.
68 lbs. dry rubber in 1913.

Total 371 lbs. in five years.

Tapping was discontinued in August, 1913, from which date the tree has been used as a seed-bearer only.

ANCYLOSTOMIASIS.

(Hook-Worm Disease.)

By Prof. J. W. W. Stephens, M.D., F.R.S.

LIVERPOOL SCHOOL OF TROPICAL MEDICINE.

HISTORICAL REVIEW.

1648. Piso recorded the existence in Brazil of a disease, Oppilatio, apparently the Latin form of Oppilação, the present-day name of the disease.

1838. Dubini discovered the Ancylostome in a patient in Milan.

1847. Bruner discovered the worm in Egypt.

1852. Bilharz also found it in Egypt.

1854. Griesinger recognised it as the cause of Egyptian chlorosis or Egyptian anæmia. He observed the wounds in the gut caused by the worms.

1861. Molin described the anatomy of *A. caninum*.

1866. Wucherer found the parasite in Brazil.

1867. Grenet and Monestier found it in Mayotta, and considered it to be the cause of "dropsical cachexia" of the negroes.

1871. Delioux de Savignac and Rodriguez de Moura considered it to be the cause of tropical anæmia.

1876. Leuckart investigated the anatomy and compared it with allied forms.

Sangalli held that not blood but intestinal "mucus" was the food of the Ancylostome.

1880. Bozzolo introduced thymol in the treatment of the disease.

1880. Perroncito announced that the Tunnel disease of the St. Gothard, "cachexia of miners," was due to the Ancylostome.

1881. Binz found the parasite in Hungary.

1882. Schulthess studied the anatomy of *A. duodenale*.

1882-1883. Leichtenstern and Menche discovered it in Germany in anæmic tile and brick makers.

1884. Firket and others discovered it in Belgian miners.

1886. Leichtenstern demonstrated oral infection.

1888.	Lutz noted that Brazilian ancylostomes had no teeth.
1895.	It was found in mines in Cornwall.
1898.	Looss discovered the cutaneous mode of infection.
1902.	Stiles recognised, and described as a distinct species, *Necator americanus.*
1904.	Campaign against hook-worm disease commenced in Porto-Rico.
1910.	Rockefeller campaign inaugurated.
1912.	*A. ceylanicum* Looss recorded from man in Bengal by Clayton-Lane.

ANCYLOSTOMIASIS.

(1) This is an extremely serious and widespread disease in the tropics caused by the presence in the gut of man of minute worms about ½ inch long. There are two worms responsible for the disease, viz., *Ancylostoma duodenale* and *Necator americanus.*

(2) It occurs mainly among those who go barefooted, *e.g.*, in Florido and Porto-Rico 90 per cent. of the rural population is infected. In German mines 30-80 per cent. of miners are infected.

The following table gives the distribution, so far as is known, of Ancylostomiasis in India :—

Date	Observer	Place	Persons examined	Percentage infected.
1893	Dobson	Assam	914	75.58
1901	Calvert	Bengal	100	83.0
904	Fearnside	Madras Presidency ...	1,509	58.87
904	Lane	Chapra Behar (Jail) ...	109	71.24
	Lane	Puri Orissa (Jail) ...	32	72.72
909	Lane	Monghyr Behar (Jail)	400	36.5
904	Maddox	Ranchi Chotta Nagpur	366	66.6
904	Bentley	Tezpur, Assam ...	600	99.98
904	Tarapore	Mandalay (Jail) ...		10.00

The symptoms of the disease are :—

1. In boys and girls physical and mental development is retarded.

2. Skin is waxy white, dirty yellow, it becomes dry and parchment-like perspiration is suppressed.

3. Ground itch, mazamorro, "new sump bunches," &c., are local names rapidly developing itching papules between the toes and elsewhere (due to entry of the larvæ).

4. Oedema of face, feet, ankles, or of the whole body.

5. Expression anxious, stupid, pupils dilated.

6. Prominent belly is common, "pot-belly," "butter milk belly" "shad-belly."

7. Appetite: Markedly affected and often perverted, a taste for lemons, pickles, earth (Geophagia), wood, paper, &c., being developed.

8. Anæmia: The most pronounced symptom; the blood may contain less than 2 million red cells instead of 5 million.

9. Nervous system. Headache, dizziness, insomnia, somnolence, and a variety of other symptoms.

It is probable that these poisonous effects are due to a poison secreted by the worm, possibly from the cervical gland.

The worms lay their eggs in the gut, and these pass out of the body. The eggs hatch in moist earth, &c. The larva grows and moults. It moults a second time, but now the moulted skin is not cast off but remains as a protective covering to the larva, while it remains in the earth. This stage of the larva is known as the "Mature Larva," and it is very important to realise that this is the only stage that can infect man, the eggs, and in fact all other stages are in this respect harmless. The mode by which these larvæ give access to the body is extremely interesting.

ORAL INFECTION. It is true as has been shown by Leichtenstern that if swallowed as in impure drinking water they can infect man, but a probably far more important method is by the skin.

DERMAL INFECTION. These larvæ have the property of boring through blotting paper, pith, &c., and not only this but they can also penetrate the healthy skin as was first shown by Looss. They penetrate through cracks in the feet or limbs and also through the hair follicles, and in their progress they produce an intense itching and often an eruption known as "sore feet of coolies," "water itch," &c. They eventually reach the blood stream and thence to the lungs where they are found in large numbers in the trachea; they pass up this and are eventually swallowed, growing into adults in the gut, where the female lays eggs, so that after infection eggs appear in the motion of the patient.

DIAGNOSIS. The finding of eggs is the only certain method of diagnosis.

TREATMENT. The principal drugs used to expel the worms are Thymol, Oil of Chenopodium, and Beta-naphthol (in large doses).

PROPHYLAXIS. Properly constructed latrines must be used, or in mines, the pail system, so that the soil is not contaminated with faeces.

J. W. W. STEPHENS.

LONDON SCHOOL OF TROPICAL MEDICINE.

A SCHOOL OF THE UNIVERSITY OF LONDON IN THF FACULTY OF MEDICINE.

UNDER THE AUSPICES OF HIS MAJESTY'S GOVERNMENT.

This School owes its origin to the Rt. Hon. Joseph Chamberlain, who, when Secretary of State for the Colonies, with the object of affording instruction to Medical men in the Colonial Service, invited the Committee of Management of the Seamen's Hospital Society to establish the School in connection with their Hospitals.

At that time Sir Patrick Manson was Medical Adviser to the Colonial Office and a member of the Honorary Medical Staff of the Albert Dock Hospital, one of the establishments of the Society. The invitation was accepted and the School was established in 1898 in connection with the Hospital at the Albert Dock in order to be in close proximity to ships arriving there, where cases of Tropical Disease might be found. For twenty years the School remained in that position, enlarged from time to time with the aid of successive Secretaries of State for the Colonies, and by generous contributions from Merchants and others interested in Tropical climes who, recognising the inestimable benefits conferred by the School, subscribed generously towards its endowment, equipment and improvement. The number of students gradually rose from about 70 until now about 200 graduates annually pass through the School.

The Colonial Office require that all Medical Officers in their service should obtain the School certificate before taking up their appointments and many of the great trading and rubber firms also stipulate that their Medical Officers shall be equally well equipped.

In 1919 the British Red Cross Society made a generous grant which enabled the Seamen's Hospital Society to set up a Hospital for Tropical Diseases at Endsleigh Gardens, London, and arrangements were then made for the School to be moved from the Docks and it is now established within the same building as the Hospital.

Many Research Expeditions have been sent by the School to various parts of the Tropics, *e.g.* to the Roman Campagna re malaria, West Indies re Filarial and other Tropical Diseases, to Uganda re Sleeping Sickness, to West Africa, to Khartoum, to Fiji re Dysentery, to Bagdad to investigate the subject of "Oriental Sore," to Aleppo, to Ceylon re Sprue, to Southern Nigeria, to the far East re Trematode infections, to the Western Pacific and to British Guiana re Filarial Diseases.

Contributions on behalf of the Hospital or School will be gratefully accepted.

Secretary, P. J. Michelli, C.M.G.,

Head Office:—Seamen's Hospital, Greenwich, S.E. 10.

AERIAL ROPEWAYS, ROPE CHUTES, ETC. The growing use of Ropeways is proving of great service in rough and mountainous or undulating country, where it is a difficult and expensive matter to transport large quantities of material from one locality to another, where good roads are practically impossible owing to the prohibitive cost of making bridle paths in such broken country largely intersected by ravines and liable to landslides. These difficulties are overcome by the use of a Ropeway, which in such cases is invaluable. Among the many special advantages which may be claimed for the Wire Ropeway is the simplicity of its construction, small initial outlay combined with low cost of maintenance, and its adaptability for traversing otherwise inaccessible country, or roads where it is impossible to run a light railway owing to buildings, ordinary roads, or even railways intervening. In cases where large ground-rents would make a light railway impossible, Wire Ropeways may be adopted with advantage, as long spans between the supports are quite usual for crossing rivers and valleys. There are several systems of Ropeways, and capacities up to 80 tons per hour in individual one to two ton loads, and at speeds varying from 2½ to 5 miles per hour can be arranged. To obtain best results, G. Cradock & Co. should be consulted as to the most suitable system for any particular work. Ropeways and Rope Chutes are in daily use in the Colonies, and the rapidly increasing demand for these for plantation work is sufficient proof of their invaluable service to such as tea planters and others for the transport of tea leaf, coffee, cotton, rice, rubber and other produce, and are an indispensable asset to efficient working and in bringing the loads rapidly from the plantations to the factory. The Chutes themselves are a very simple and invaluable method of conveyance, and in suitable circumstances are probably the most economical and expeditious form of direct transport known. The length of Chutes may range from a few 100 feet up to about 1½ miles in length, the loads being sent down in bags weighing usually about 100 lbs. The Chutes are particularly adaptable, and no skilled labour is necessary for their erection.

The Company have supplied and carried out contracts for all the above installations in many parts of the world including India, Burma, Ceylon, Dutch East Indies and elsewhere, and would be pleased to forward their recently published and illustrated Brochure dealing with these Cableways, Aerial Ropeways, Rope Chutes, etc., to intending clients.

(See the Two preceding pages.)